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THE CHICAGO STREET-LIGHTING SYSTEM.

In this issue appears the second and final section of a description of the new and very interesting street-lighting system of the city of Chicago, to which we have made reference from time to time. The lighting situation in Chicago is an interesting one, not only by reason of the somewhat unusual contractual arrangements by which the Sanitary District undertakes to light the streets, but also on account of the use of flame-arc lamps on a very large scale for the first time in American practice. The long-burning flame-arc lamp is by no means a novelty, since it has been in successful use in England for three or four years, but its adaptation for use on alternating-current circuits and the appearance of suitable lamps and electrodes of American manufacture have given it recently a much more important position in the art than it had at first. When the long-burning flame-arc lamp was built exclusively for direct-current circuits and the electrodes were obtained only abroad and at large expense, it could make no headway against the magnetite-arc lamp as developed in this country. However, when our manufacturers developed the present lamp and electrodes the system became a useful one for the very numerous cases in which alternating current is much more conveniently obtainable than direct current.

The requirements in Chicago were a powerful and valuable stimulus to the production of improved lamps, and the results seem to have shown that the present product possesses much of merit. These lamps in considerable numbers have now been in use long enough to permit one to form some judgment of their comparative qualities. The record of outages from all causes is less than one-half of 1 per cent per day, which is a decidedly good record, particularly for a new lantern. Difficulties other than outages tending to make the lamp troublesome or expensive to operate have not yet been made public, and full information may be lacking for some considerable period.

The standard construction for the poles is a rather interesting one. A plain but very neat iron structure carrying the lamp on a 30-in. bracket with the arc at an elevation of 25 ft. has been adopted. The height was adopted after a considerable discussion, and it is about right for districts where the lamps are fairly closely spaced. It seems a little low for lamps spaced as much as 250 ft. apart, the common distance in the outlying districts. The lamps are lowered for trimming, being provided with automatic series cut-outs. The lowering gear is entirely concealed, and the whole arrangement appears to be very workmanlike and convenient. We shall await with considerable interest an authoritative report of costs of operation with these new lamps. Their light-giving efficiency is extremely high. Their adaptation to use on alternating-current circuits is a matter of considerable economy in equipment cost, and

their place in the future of the art will hinge chiefly on the costs of trimming, cleaning and repairs. From the 6000 lamps now in use reliable figures should soon be obtained.

The change in the arc-lighting situation for the past three or four years has been astonishing even to those whose minds are pretty well seasoned to the rapid changes in electrical conditions. Within that time the old open-arc lamp, already obsolescent, has almost entirely disappeared except in a few places where it is retained for reasons wholly of local significance. The inclosed-arc lamp has become obsolescent for street work, and for commercial lighting it has been in large measure replaced by the intensified and flame-arc lamps. The magnetite-arc lamp, despite the confinement of its use to direct-current circuits, has made an immense change for the better in street-lighting conditions, and now the long-burning flame-arc lamp is here and an improved titanium-arc lamp is on the way for street lighting by alternating-current circuits.

One of the most interesting questions outstanding is the position of the large tungsten lamp in street lighting. Had it appeared before the advent of the luminous and flame-arc lamps in common practice it would unquestionably have superseded the carbon-arc lamp as a street illuminant within a very short time. There is a large difference between from 1.5 to 2.5 watts per candle in the old arc lamps and from 0.5 to 0.75 watt per candle in the new arc lamps, so that even with 1 watt per candle in the large tungsten lamps competition is not easy. We cannot help feeling, however, that the large tungsten units will have a far better field in the next few years than they have had up to the present, and that in the places where arc lamps are now spaced at distances of from 200 ft. to 300 ft. there is much to be said in favor of the incandescent substitute.

THE USE OF REACTANCE IN TRANSFORMERS.

Until comparatively recently it was held as an article of faith by orthodox electrical engineers that internal reactance in a transformer was pernicious and obnoxious—a thing which could not indeed be extirpated completely, but nevertheless one which the designer abhorred and burned the midnight taper to exorcise. Indeed, the reactance factor of a transformer, or the ratio of its internal reactance to its internal resistance, on the basis of unity ratio of transformation, was commonly regarded as a comparative measure of the imperfection of transformer design for a given type, output and voltage ratio of transformation.

A paper read by Mr. W. S. Moody at the last New York meeting of the American Institute of Electrical Engineers shows how completely the above set of notions has been modified by recent practice, thus laying another illusion on the scrap heap of time. It is still true that in the case of the ordinary small transformer on electric-lighting mains the less internal reactance it has the better it will regulate its voltage and give satisfactory service, but in the case of large transformers, especially those delivering energy to synchronous converters in extensive high-tension generating systems, the conditions favoring inherent regulation become secondary to those favoring the safety of the generators, in the event of accidental short-circuits.

With the recent increase in the size and output of generating stations the mechanical stresses that may be thrown suddenly upon the generators in case of a short-circuit have increased at a rapid rate. If such a short-circuit occurred at a considerable distance from the station the resistance of the transmission lines up to the fault might serve to keep the overload currents and mechanical stresses down to a safe limit; but if the short occurred close to the busbars the amount of electric power which the generators could collectively throw into the breach might involve mechanical stresses sufficient to wreck a machine. Although such an accident might be reasonably guarded against by various devices, nevertheless the mere possibility of such a mishap should be prevented automatically. The safest way at present is to inject such reactance into the generator system as will confine a short-circuit to the required safety limit.

As the paper points out, there are two ways of inserting reactance between the source of supply and the collector rings of a converter. One is to use an external reactance coil and the other is to insert extra reactance into the transformers delivering energy to the converter. In the case of external reactances, these are massive devices of concrete and air. That is, they have non-ferric magnetic circuits and constant values of inductance at all loads. In the case of the internal reactances of transformer coils, non-ferric magnetic circuits cannot be used with advantage, partly because the air space needed for a non-ferric reactance path is too expensive inside a transformer, and partly because large air-path magnetic leaks in transformers produce divergences in the magnetic flux, which in turn set up eddy currents in the coils. An ingenious arrangement of incompletely closed ferric magnetic leaks in transformers has therefore been worked out.

It would seem that magnetic saturation must play an important and undesirable part in the characteristics of the leakage flux paths. If the object in providing the extra leakage is not to increase the series reactance in normal service but rather to minimize the short-circuit current, this object is largely defeated by the unavoidable presence of high series reactance at light and normal load and a marked reduction in reactance at overload and short-circuit.

COLORS OF ILLUMINANTS.

In view of the present interest in so-called artificial daylight a recent research by Dr. Voege, of Hamburg, contains many interesting features. It is a study of the color composition of a score of sources with the view of determining their exact color relations with one another and with natural daylight, so far as there is any such thing. Our readers, of course, remember the studies of Dr. Ives in the same direction made with the colorimeter. There have also been many spectro-photometric investigations of a few sources. Dr. Voege's method of investigation was slightly different from any of these in that it was based on isolating certain spectral regions by means of a carefully adjusted set of filters made from Jena glass, the transparency of which had been accurately determined. Using duplicate screens, it was possible accurately to compare by ordinary photometry

the relative intensities at various—in this case five—regions of the spectrum. The results of these comparisons form a valuable contribution to the literature of photometry.

Perhaps the most striking feature of Dr. Voege's tabulated results is the demonstration of the uncertainty of the datum point in any consideration of daylight. It has been many times shown, of course, that a cloudy sky is radically different in color effect from a blue sky, and both of these from sunlight. For example, in Dr. Voege's results it appears that the blue component of the blue sky is 2.5 times as intense as the similar component in sunlight, while through the entire red end of the spectrum the blue sky shows a deficit of from 15 to 20 per cent. Both differ in color by a considerable margin from light received from a cloudy sky. Comparing now the group of incandescent electric lamps, having carbon, tantalum and tungsten filaments, with the Nernst glower in addition, it is found that through the entire green and blue end of the spectrum the differences within the group are practically negligible. The carbon-filament lamp shows a slight but not large excess of red over the three others, which are so nearly alike that the variations are hardly worth mentioning. The acetylene flame runs pretty near to these incandescent lamps, but on Dr. Voege's figures is a slightly better approximation to white than any of them. The incandescent gas lamp clearly belongs in the same category with acetylene and the incandescent electric lamps in color, while the petroleum burners, two of which were tested, are considerably redder than the carbon-filament lamp.

Passing now to the group of arc lamps, the common open arc runs pretty close to direct sunlight, but with somewhat greater strength than the red end of the spectrum. The light from the intensified inclosed-arc lamp is about as much bluer than sunlight as that from the ordinary arc lamp is redder; it is less blue than light from a clear sky, and slightly bluer than that from a cloudy sky. A flame lamp fitted with Siemens white-light electrodes runs wonderfully close to the color of a cloudy sky, showing a slight excess in the green, while the yellow and red flame electrodes give about the result that their names would indicate. Of the less familiar sources of light the mercury tube with rhodamine reflector gives a good approximation to the light of an overcast sky until the red is reached, when it falls off somewhat, the deep red being conspicuous by its absence, although the lighter reds are well represented. The one fact which stands out conspicuously as the result of this particular set of tests is that open and intensified arc lamps and flame-arc lamps with "white" electrodes all give a pretty close approximation to natural light, varying among themselves and from the average of natural light less than natural light itself varies from its own average. Could we see simultaneously sunlight and the light received from clear and cloudy skies we should be tempted to denounce natural light as singularly bad for color matching. Fortunately one's memory for color is anything but precise, so that the gradual variations between noon and sunset are not noticed. With very little modification of several artificial illuminants it is possible to produce an illumination quite close to average daylight, if there could be any general agreement as to the definition of the latter.

EFFECT OF TEMPERATURE UPON HYSTERESIS LOSS.

At the last meeting of the American Institute of Electrical Engineers in New York City a paper was presented by Prof. Malcolm Maclaren on the effect of temperature upon hysteresis loss in sheet steel. In a paper of similar title presented in April, 1911, the results of a research on hysteresis losses in furnace-heated steel rings had shown that the loss per cubic centimeter and cycle diminished markedly, for a given flux density, as the temperature increased, until at a critical temperature not far below 800 deg. C. the loss disappeared altogether. Moreover, it transpired from a calculation of the results recorded in those measurements that at all the temperatures examined up to over 700 deg. C. the loss varied very nearly as the 1.6th power of the flux density.

In the new paper investigation was directed particularly to the effect of rate of heating or cooling on the hysteretic loss, and also to the shape of the hysteresis loops at different temperatures. In regard to the rate of heating, no marked effects were noticeable, but the effect of long-continued temperature elevation in increasing the loss, according to the well-known aging effect in transformers, was clearly shown. The salient result reached and presented in the paper is that the falling off in hysteretic loss at elevated temperatures is mainly due to a reduction in coercive force. It is well known and was pointed out by Mascart and Ewing that if a plot be made with the flux density in gausses as ordinates and the magnetic intensity in gilberts per centimeter as abscissas, the area of the loop formed in one regular cycle of magnetization will be 4π times the hysteretic loss in ergs per cubic centimeter. The area inclosed, for a given range of flux density, will manifestly vary with the breadth of the loop. The breadth, in turn, will vary with the coercive force, or that magnetic intensity which is necessary to apply to the tested sample, in order completely to destroy its residual magnetic flux density. It is clear that if in two different samples of magnetic material, each magnetized cyclically to say 10,000 gausses, one has a coercive force of 1 gilbert per centimeter and the other a coercive force of 2 gilberts per centimeter, then unless the shapes of the two loops differ the area inclosed by the second loop will be double that in the first, or the specific hysteretic loss of the latter will be double that of the former.

In the cases investigated and reported in the paper the flux density diminished distinctly as the temperature of the test ring advanced from 25 deg. to say 725 deg. C., but not very greatly; whereas the coercive force diminished very greatly. Consequently, the diminution in the area of loop and in specific hysteretic loss is in these cases mainly attributable to diminished coercive force with rising temperature. From a physical standpoint, we may explain the above phenomenon by saying that as the temperature of sheet steel is increased the magnetic molecules become freed from each others' entangling magnetic influences and also, perhaps, become more delicately pivoted, so that in obedience to a reversal of magnetizing force they are more easily reversed and require a smaller magnetic force to reverse them. In other words, their coercive force is reduced.

CHICAGO CHOSEN FOR N. E. L. A. CONVENTION.

At a meeting of the executive committee of the National Electric Light Association it was unanimously voted to accept the invitation of the Commonwealth Edison Company to hold the 1913 convention of the association in Chicago. The exact dates of the convention have not yet been fixed, but they will probably fall in either the third week in May or the first week in June. The fourth week in May will not prove suitable because Decoration Day will fall on Friday of that week. It is predicted that the attendance at the convention will reach 7500.

ENGINEERING LECTURES AT BROOKLYN INSTITUTE.

The course of scientific lectures arranged by the Brooklyn Institute of Art and Sciences for the present season is of unusual importance and interest. Sir William Ramsay will again be heard at the Institute, where his lectures will be given under the joint auspices of the department of chemistry of the Institute of Arts and Sciences and the Brooklyn Polytechnic Institute. They will relate to those elements and conditions of the atmosphere which have been discovered by Sir William. There will be three lectures as follows: Oct. 22, "The Ancient History of the Gases of the Atmosphere"; Oct. 29, "The Discovery of Argon, Helium, Neon, Krypton, Xenon"; Nov. 5, "Nitron, or the Radium Emanation." The lectures will be illustrated by the aid of the spectroscope and the stereopticon.

The department of electricity has also arranged for a series of illustrated lectures on electrical engineering at the evening meetings of the department. Prof. John S. McKay, of the Packer Institute, will lecture on "Modern Views of Electricity," the date to be announced later. On Nov. 6 Mr. George I. Rhodes, New York, will lecture on "The Making of Electricity"; Dec. 7, Prof. Sidney W. Ashe, Harrison, N. J., on "Modern Illuminants"; Feb. 1, Mr. Bancroft Gherardi, New York, on "Long-Distance Underground Telephony"; March 8, Mr. Nicola Tesla, New York, on "Is Wireless Power Transmission Feasible?" April 5, Mr. D. B. Rushmore, Schenectady, on "The White and Black Coal Electric Problem"; May 3, Prof. Michael Pupin, of Columbia University, on "Long-Range Transmission." The department of physics has also announced three Tuesday evening illustrated lectures on "Light" by Prof. Robert W. Wood, of Johns Hopkins University, which will be given on April 8, 15 and 22.

MEETING OF N. E. L. A. RATE RESEARCH COMMITTEE.

A meeting of the rate research committee of the National Electric Light Association was held at the Hotel Touraine, Boston, on Oct. 4 and 5. Chairman E. W. Lloyd, Chicago, presided, Secretary W. J. Norton and Messrs. L. H. Conklin, of Scranton, S. E. Doane, of Cleveland, and R. S. Hale, of Boston, also being present. A number of matters in conection with the *Bulletin* were discussed, and it was decided to try so far as possible to keep distinct those questions regarding the proper amount of gross revenue, involving such matters as the proper return on the investment, etc., on the one hand, and, on the other, questions relating to rates for different customers which are concerned primarily with the subject of discrimination. A number of companies have reported their rates on the forms suggested by the committee and considerable work was done in collating these reports. The next meeting will be held at Chicago on Nov. 20.

KENNELLY ON HYPERBOLIC FUNCTIONS.

Under the auspices of the Brooklyn Institute of Arts and Sciences, Dr. A. E. Kennelly, of Harvard University, on the evening of Oct. 10 gave the first of his series of five lectures on the elements of hyperbolic functions and their application to electrical engineering before an interested and enthusiastic audience of about 300 in the physics lecture room of Brooklyn Polytechnic Institute. Dr. Kennelly devoted his first lecture to a discourse on the nature of hyperbolic functions and the elements of hyperbolic trigonometry, forming an introduction to the future consideration of linear conductors, both uniform and non-uniform, when subject either to steady continuous or alternating impressed electromotive forces. An announcement of the full lecture course which Dr. Kennelly will present appeared in our issue of Sept. 28, page 640. In general the subjects considered will be the same as those taken up in a similar course of lectures which he delivered at the University of London in 1911.

Owing to the unexpectedly large attendance, which somewhat taxed the capacity of the lecture room, Prof. Samuel Sheldon announced that a larger meeting place might be decided upon, but in that event it was arranged that a notice of the change should appear in the *Electrical World*.

ELEVENTH JOVIAN CONGRESS.

The Order of Rejuvenated Sons of Jove held its eleventh annual congress in Pittsburgh Oct. 14, 15 and 16, amid great enthusiasm. Over seven hundred members of the order were registered. Among the business matters which came up for consideration were important changes in the constitution and by-laws, intended for the betterment of the order. Tuesday night there was a large parade, followed by a rejuvenation at which 117 candidates were initiated. In the casting of ballots for eleventh Jupiter a spirited contest developed between Mr. W. M. Deming and Mr. F. E. Watts. After the Ohio ballot was cast Mr. Deming gracefully conceded Mr. Watts' election and moved that it be made unanimous, which was done. The following incoming officers of the eleventh Jovian congress were unanimously elected: Neptune, L. M. Cargo; Pluto, A. W. Woodville; Vulcan, C. L. Martin; Hercules, H. A. Hart; Avrenim, W. H. Vilett; Mars, W. D. Shaler; Apollo, L. S. Montgomery; Mercury, E. C. Bennett. More than three hundred members attended the banquet given on the evening of Oct. 16. Mr. Hugh T. Wreaks, of the National Board of Fire Underwriters, addressed the meeting, suggesting the great help the Jovian order can be in the further reduction of fire hazards. The congress just closed carried off the honors as the greatest event in the history of the Jovian order. The 1913 Jovian congress will be held in New York City on Oct. 15 and 16 during the New York Electrical Show.

PITTSBURGH SECTION, I. E. S.

At a meeting of the Pittsburgh Section of the Illuminating Engineering Society held on Friday, Oct. 11, the following papers read at the Milwaukee convention of the Association of Iron and Steel Electrical Engineers were abstracted: "Modern Illumination in the Iron and Steel Industry," by Mr. C. E. Clewell; "The Incandescent Lamp in the Steel Industry," by Mr. Ward Harrison, and "Curves and Data for Illumination Calculation," by Mr. C. J. Mundo. The following papers are scheduled for presentation at the regular monthly meetings of the Pittsburgh Section: November, "The Use of Lenses in Illumination," by Prof. H. S. Hower; December, "Store Illumination"; January,

"Street Lighting," by Mr. C. A. Stephens; February, "Gas Illumination"; March, "The Incandescent Lamp in the Central-Station Business"; April, "Some Phases of Railroad Illumination," by Mr. J. L. Minick; May, "Physiological Aspects of Illumination." Arrangements have been made for a joint meeting with the local section of the American Institute of Electrical Engineers, at which it is probable a paper on "Street Lighting" will be presented by Mr. C. E. Stephens. Preceding the regular monthly meetings lectures of about twenty minutes' duration on the elementary phases of the subject of illumination are to be given by Prof. H. S. Hower.

A. I. E. E. AFFAIRS.

At a meeting of the board of directors of the American Institute of Electrical Engineers in New York on Oct. 11, 1912, the report of the finance committee submitting the budget covering the proposed expenditures for the coming year, amounting to $114,307.34, for the various activities of the Institute during the appropriation year beginning Oct. 1, 1912, was adopted. Upon the recommendation of the sections committee, authority was granted to organize branches of the Institute at Highland Park College, Des Moines, Ia., and the University of Oklahoma, Norman, Okla.

A by-law recommended by the sections committee relating to the expenses of meetings of Institute sections was adopted. This by-law provides that the appropriation of Institute funds during any fiscal year for the meeting expenses of any section shall not exceed a sum determined as follows: (a) Fifty dollars for each section independently of the number of members in the section. (b) One dollar and twenty-five cents for each Institute member residing within the territory of the section at the beginning of the administrative year, Aug. 1.

The following by-law recommended by the meetings and papers committee was adopted:

"The manuscripts of any papers to be presented at the Institute meetings or conventions after the date of Feb. 1, 1913, must be received at Institute headquarters for the consideration of the meetings and papers committee not less than sixty days before the date of presentation, and no papers shall be announced for presentation at any specific meeting of the Institute until after the paper has been accepted for presentation by that committee.

"The executive committee, however, shall have the power to waive the sixty-day requirement upon the request of the chairman of the meetings and papers committee."

Upon the recommendation of the meetings and papers committee, it was resolved that it shall be the duty of the meetings and papers committee of any one year to arrange for a sufficient number of papers for presentation at the first two meetings of the year succeeding that for which the committee was appointed and to turn over such papers for the use of the succeeding committee.

Fifty-seven associates were elected, thirty-nine students were ordered enrolled and three associates were transferred to the grade of member, in accordance with the recommendations of the board of examiners.

Fifty-one applicants were transferred from the grade of associate to the grade of member, and seventy-six applicants were transferred from the grade of member to that of fellow, in accordance with the provisions of the special section of the Institute constitution adopted last June.

Upon the invitation of the executive committee of the American Mining Congress, President Mershon was authorized to appoint two delegates to represent the Institute at the fifteenth annual session of the Congress at Spokane, Wash., Nov. 25 to 28, 1912.

The badge committee, which had been appointed to recommend the forms of badge to be used for the three grades of Institute membership which were established last June in place of the two grades formerly existing, reported and recommended that the present forms of badges for associates and members remain unchanged, and that the form of badge for the grade of fellow shall be of the same size and shape as the members' badge and identical in design, including the lettering, the only difference being that the fellows' badge shall be the reverse of the members' badge in color—namely, shall be blue lettering on a gold background. The recommendations were adopted.

The thanks of the Institute were voted to Mr. George L. Colgate, of Rochester, for his presentation to the Institute, through Mr. John C. Parker, of interesting historical documents relating to a bill introduced in the Virginia Legislature in 1889 "for the prevention of danger from electric currents." The documents include a lead-pencil memorandum of a proposed modification of the bill in the handwriting of Mr. Thomas A. Edison and signed by him.

OCTOBER MEETING A. I. E. E.

Two papers were presented at the opening fall meeting of the American Institute of Electrical Engineers, held in New York on Oct. 11. The first of these was one by Mr. W. S. Moody, Schenectady, N. Y., entitled "The Use of Reactance in Transformers," and the other was one by Prof. Malcolm MacLaren, of Princeton, entitled "The Effect of Temperature Upon Hysteresis Loss in Sheet Steel."

In the paper by Mr. Moody it was stated that, contrary to former practice in transformer design, an attempt is frequently made at the present day to obtain increased rather than decreased leakage reactance. Such reactance is desirable where a variable voltage is needed for use with synchronous converters and where the current which can be produced on short-circuits must be limited. It has recently become customary to specify that transformers must not have less than 5 per cent reactance for the protection of transformers, switches, generators, and in fact all parts of the system, against the high mechanical stresses at excessive currents. When a great amount of reactance is desired for flexibility in transformation ratio, as for use with synchronous converters, the result can be obtained by placing a laminated iron structure between the primary and secondary windings in such a way as to form a low reluctance path for the leakage flux. The use of such a device does not extend the possibility of current-limiting reactance, as the amount of iron that would be necessary to carry the entire flux on short-circuit would result in a prohibitive amount of reactance from a regulation standpoint.

Professor MacLaren described the results of tests of hysteresis loss made upon two samples of sheet-steel stampings at temperatures reaching as high as 777 deg. C. One of the samples was made of commercial steel, such as is used for pole punchings. The other sample consisted of high-percentage silicon transformer steel. It was found that the high-percentage silicon steel becomes non-magnetic at a lower temperature than does the ordinary steel, and also that its permeability falls with increasing temperature, while the permeability of the ordinary steel first rises and then decreases with increasing temperature.

Discussion.

The discussion was opened by Mr. Philip Torchio, of New York, who described and illustrated reactors connected in series with transformers for increasing the series reactance. The reactors described possess pancake windings and are placed in inclosing cases supported on fireproof and insulating materials throughout. Mr. Torchio stated that the pancake coil can be designed more efficiently and, for the same floor area, of considerably less height than can an equivalent drum-wound reactor. In order to obtain ap-

proximately the same percentage of reactance for the same floor area, a drum-wound coil would be twice as high as an equivalent pancake-wound coil. The reactors are built up of horizontally wound spirals insulated by porcelain arms provided with suitable recesses for the windings. The arms are assembled radially as vertical walls between a center core of alberene stone and an outer inclosing wall of special porcelain segments. The latter is supported at two ends by heavy concrete headers fastened to the wall by a series of glass bolts passing through the headers and through the special porcelain segments from top to bottom. Constructive details were given for a set of reactors used with three 20,000-kw, 6600-volt, 25-cycle generators installed by the New York Edison Company. Each reactor has 4.2 per cent reactance, and at a full-load current of 1750 amp its copper loss is 6.236 kw.

In a communication from Mr. L. W. Chubb, of Pittsburgh, read by Prof. Charles F. Scott, it was predicted that the study of the effect of high temperature in hysteresis loss will result in a rapid improvement in sheet steel.

Prof. Comfort A. Adams, of Cambridge, showed from physical reasonings why the reactance should be greater in a large transformer than in a small transformer, other things being equal. The smaller reactance is found in the larger transformers because special pains are taken to minimize the reactance in the larger units.

Mr. D. B. Rushmore, of Schenectady, remarked that there is a demand at the present time for a reactor which will possess little reactance under normal conditions but at excess load will introduce a very large reactance. The introduction of reactance into the transformer does not protect the transformer itself. The preferable method seems to be to place reactors in the busbars used in paralleling the generators or transformers.

Mr. H. W. Flashman presented a written discussion for Mr. William H. McConahey, of Pittsburgh, in which it was shown that changing the design of a transformer in order to increase its reactance does not necessarily reduce the stresses under short-circuit conditions. The elements upon which the reactance of a transformer depends determine also the short-circuit stresses. Mention was made of a recent case involving the design of certain two-to-one ratio transformers for railway service, the short-circuit stresses in which were found to be so heavy that it was deemed advisable to reduce them by mechanical separation of the primary and secondary parts of the winding. This arrangement resulted in increased cost of the transformer, but proved to be cheaper than supplying outside reactors, which in this particular case would not have been acceptable.

Prof. Charles F. Scott called attention to the decrease in series reactance under short-circuit conditions when a magnetic shunt is placed between the coils, on account of saturation of the leakage path. In order to avoid saturation it would be necessary to build magnetic shunts with a cross-section equal to the cross-section of the main transformer core, which proportion would introduce a number of difficulties and complications.

Mr. H. M. Hobart, of Schenectady, expressed the opinion that, rather than go to the earlier extreme of building transformers with a minimum of reactance or follow the present tendency to increase artificially the internal reactance of the transformer, it would be preferable to build transformers without reference to reactance and then employ series reactors if the internal reactance proved insufficient. The transformers should be designed from the standpoint of heating and efficiency, and if the reactance obtained under these conditions is not sufficient, external reactors should be used.

Mr. M. D. Ayres remarked that the external reactor is undesirable, not only on account of the space it occupies, but even more so by reason of the fact that it can be placed only in certain limited positions and connections to it must be made by heavy conductors.

INSTITUTE AFFAIRS.

At the conclusion of the discussion on the above-mentioned papers, President Mershon announced that a mid-winter convention will be held in New York during February, 1913, to be devoted to the general subject of "The Rating and Testing of Electrical Machinery and Apparatus." Adjournment was taken to the Institute offices on the tenth floor of the Engineering Societies Building, where a smoker was held and light refreshments were served. This entertainment feature of the Institute's activity is provided by contributions made by members in the New York territory, and its continuance is assured by reason of the success which attended similar arrangements made last season.

NEW YORK SECTION, I. E. S., MEETING.

At a meeting of the New York Section of the Illuminating Engineering Society held on Oct. 10 two of the Niagara Falls convention papers were presented for discussion. The paper by Messrs. Clarence L. Law and A. L. Powell on "Present Practice in Small Store Lighting with Tungsten-Filament Lamps" was read by Mr. G. H. Stickney. A brief abstract of this paper was given in our issue dated Sept. 28. The authors reported the results of an investigation of over 800 small stores in New York City, Newark and adjoining towns. Some of the stores were located on Broad Street or Market Street, Newark, others on Fifth Avenue, Broadway and other prominent streets in New York, the idea being to investigate only the lighting installations typical of the small stores throughout the country. Note was made of the size of the storeroom, the number and size of the lamps employed and the character of the merchandise sold. The results were expressed in watts per square foot, the values of which ranged from 0.25 to 4.95, with the following averages for the classes of stores noted: Art store, 1.01; bakery, 0.82; barber, 1.23; cigar, 1.45; clothing, 1.37; confectionery, 0.97; delicatessen, 1.11; drug, 1.01; dry goods, 1.26; florist, 1.07; grocery, 0.98; haberdashery, 1.43; jewelry, 1.54; meat market, 0.91; millinery, 1.28; music, 1.05; restaurant, 1.08; shoe, 0.98; stationery, 1.02; wine and liquor, 1.20.

In opening the discussion on this paper, Mr. G. F. Barrows claimed that the paper is of value to gas salesmen as well as electric salesmen, because they will be able easily to convert the value in watts per square foot into cubic feet of gas per hour per square foot.

Mr. J. Hunter said that account should have been taken of the height of the walls and the color of the decorations, since the light reaching the illuminated plane depends largely upon the amount absorbed by the walls.

Mr. Norman Macbeth remarked that the paper possessed a double value in presenting highly desirable information in convenient form, without the use of technical terms.

In closing the discussion, Mr. Stickney stated that changes in the height of mounting of lamps in stores produces two effects which tend to compensate each other. The increase in height tends to decrease the amount of illumination received directly from the lamps but to increase the amount reflected from the walls.

HIGH-PRESSURE GAS LIGHTING.

Mr. G. S. Barrows presented for the authors, Messrs. F. W. Goodenough, Oscar Klatte and R. N. Zeek, papers relating to the general subject of high-pressure gas lighting, under the sub-titles "High-Pressure Gas Lighting in Great Britain, in Germany and in America." High-pressure gas lighting has been employed in Germany for the past ten years and has reached a high stage of development. The lamps employed have from one to five mantles and vary in candle-power from 500 to 4000. An indication of the growth of this kind of lighting is found in the city of Berlin, where up to 1905 about 15 miles of street were lighted with electric

arc lamps. From 1905 to 1911 a mile of electric lighting was added. In 1905 about 4 miles were lighted with high-pressure gas, but during the period from 1905 to 1911 32 miles of high-pressure gas lighting were added, and a further extension of 42 miles is contemplated. There are several high-pressure gas-lighting installations in America, but thus far they have not passed beyond the experimental stage.

Mr. Norman Macbeth claimed that the rapid development of gas lighting in Europe as compared with America represents an indictment either of electric men abroad or of the gas men here. He claimed that the gas manufacturers in this country do not appreciate the opportunities that exist in their own field.

Mr. H. T. Owens called attention to the increasing interest aroused in high-pressure lighting, which doubles the efficiency as compared with the methods in common use to-day.

In closing the discussion Mr. Barrows remarked that while the life of the incandescent mantles as first used for high-pressure lighting in this country was about ten days, improvements in mantles have caused an increase in life to about fifty days.

SOCIETY ACTIVITIES.

The meeting was held at Keen's Restaurant on Thirty-sixth Street and was preceded by an informal dinner. This plan proved very satisfactory and will probably be continued in the future. Chairman Stickney announced that preliminary arrangements have been made for practically all of the meetings during the season now beginning. The next meeting will be held on Monday, Nov. 18, in the auditorium of the New York Edison Company on Twenty-seventh Street, in co-operation with the New York Companies Section of the National Electric Light Association. Mr. Preston S. Millar will present a paper with demonstration of lighting effects. The December meeting will be held in conjunction with the New York Committee for the Prevention of Blindness. The January meeting will be combined with a meeting of the National Commercial Gas Association, and the February meeting with the Municipal Art Society. The March meeting will be held jointly with the Society of Mechanical Engineers. An attempt is being made to arrange a joint meeting with the American Institute of Electrical Engineers.

Mr. Preston S. Millar, as general secretary of the society, explained the movement now under way to alter the constitution of the Illuminating Engineering Society in order to admit as sustaining members persons, or representatives of companies, who may desire to express their appreciation of the work accomplished by the society in the form of contributions for its running expenses. Another proposed change relates to the shifting of the beginning of the society's year from January to midsummer, in order to correspond with the season of the society's activities.

ELECTRICITY AND THE NATIONAL GAME.

The debt which the sporting fraternity, and if the truth be told, a large percentage of the red-blooded citizenship of North America, owes to electricity in connection with the reports of the baseball championship series just concluded between the Boston and New York teams is one not easily exaggerated. There is little that is new in the transmission of news of this kind by telegraph, telephone and wireless service, but the scale upon which the work has been handled in this instance deserves more than passing mention. At Fenway Park, for example, arrangements were made to accommodate representatives of no less than 269 newspapers, about fifty private trunk telegraph lines being in service directly between the press box and the newspaper offices in New York, Washington, Chicago, Buffalo and many other cities. To provide the necessary telegraph capacity the press box was enlarged to five times its size earlier in the season. By a comprehensive articulation of main and branch lines practically every cross-roads telegraph office in the country and every corner grocery housing a telephone were kept in constant touch with the progress of the games, and in not a few cities electric scoreboards showing every play and connected directly with the scene of combat aroused the enthusiasm of thousands of persons many hundreds of miles from the field. There is something stirring in the idea of every ball pitched being signaled by wire and wireless throughout a continent, and recent improvements in scoreboard design which show the position of the ball and the actual running of bases at every instant following the play represent a real triumph in electrical methods.

The modern scoreboard as used in this series possesses noteworthy characteristics, including immediate and permanent indication, fireproof wiring, illumination on a scale comfortable to the eye, and a sectionalized construction which facilitates assembly and dismantling in the shortest available time. The use of 4-cp red and yellow lamps at each position in the field and at the bat to show the team work, combined with a white lamp at each position to show the location of the ball at every instant, simplifies the problem for the operator and spectator alike. A string of alternate red and yellow lamps set in sockets around a diamond about 4 ft. square and connected at the rear with hand rheostat handles solves the issue of base running, and corresponding lamps grouped under appropriate special plays provide for showing everything done on the field with remarkable celerity and effectiveness. On the field itself electricity plays a vital part in enabling the crowd to follow the fine points of the game through the indications of a local scoreboard, and in the coming winter moving-picture machines driven by small motors and illuminated by arc lamps will continue an electrical service which is almost above praise in its flexibility in the face of such an enormous peak-load demand for information.

ILLUMINATION FOR NAVAL PAGEANT IN NEW YORK HARBOR.

During the past week the greatest assemblage of warships ever seen under the skies of the western world was mobilized in New York Harbor. In the notable pageant at New York last year there was a total of ninety-nine ships, twenty-four being battleships, while in the mobilization just

Fig. 1—Riverside Drive During Naval Pageant.

ended thirty-two battle ships anchored in the Hudson and there were 127 ships of all classes strung along the river from Twenty-third Street to Spuyten Duyvil. While during the day the ships, bedecked with gayly waving flags, presented a splendid marine spectacle, with the fall of darkness the masts and hulls outlined with incandescent lamps made a noteworthy sight. Riverside Drive was especially

illuminated for the occasion, and the mist which hung over the river imparted to the scene a fairylike aspect. Unfortunately, the great distance between the ships and the shore, and the mist, made it impossible to obtain good photographs of the illumination. On Monday the armada was inspected by the President and the Secretary of the Navy. On Tuesday the President's yacht anchored near the Statue of Liberty, and as the great fleet passed out to sea each ship thundered forth its presidential salute of twenty-one guns. The demonstration was the greatest ever held in American waters. The presence of the fleet in the Hudson River, the illumination of Riverside Drive and the warships in the evening, moreover, caused a tremendous rush of business on the local railway lines. Up to Monday the record for passenger traffic on the New York subway was held by one of the days of the Hudson-Fulton celebration, when the number of passengers carried was 1,179,512. This record, however, was passed on Monday, Oct. 14, when 1,199,747 passengers were carried without confusion or delay.

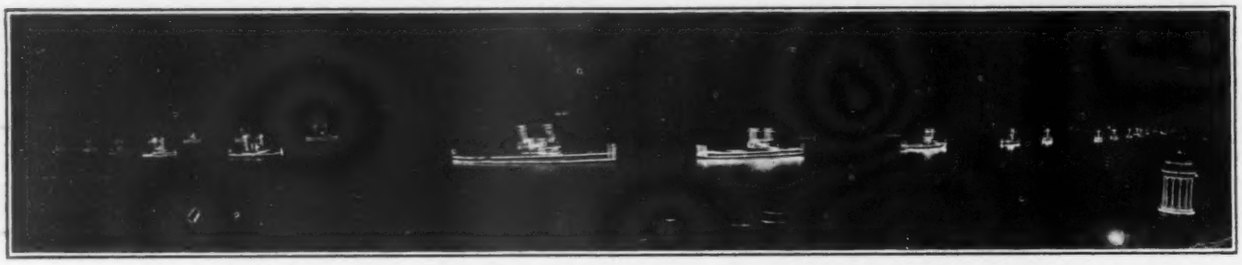

Fig. 2.—View of Illuminated Warships at Anchor in Hudson River Off Riverside Drive, New York.

NEW ENGLAND SECTION, N. E. L. A., CONVENTION.

The fourth annual convention of the New England Section of the National Electric Light Association was opened at Paul Revere Hall, Mechanics' Building, Boston, Mass., on Tuesday, Oct. 15, with President J. S. Whitaker, of Portsmouth, N. H., in the chair. Advance registrations indicated that the attendance would exceed that of all previous conventions of the section, as special efforts had been made to invite all members of the national organization to New England at this time. As was the case with the convention last week of the Electric Vehicle Association of America, the meetings were assigned to the building housing the Boston 1912 Electric Show.

ASSOCIATION AFFAIRS.

Mr. Whitaker in his presidential address explained the new method of reimbursing geographical sections from membership dues authorized at the Seattle convention of the present year, and stated that the national body now has a total roll of 12,500 members, representing 90 per cent of the investment in central-station properties in the country. The New England Section now has 860 members, the area of the territory included being only 2 per cent of the total and the population 7 per cent. About 10 per cent of the total investment in central-station properties is located in New England. The central-station industry represents a total investment in this country of $2,500,000,000 and an annual gross income of $340,000,000.

The report of the secretary, Miss O. A. Bursiel, Boston, was read by Mr. Welles E. Holmes, Cambridge, treasurer. Additions to the membership of the section this year total 160. It was announced that the Friday "electrical luncheons" in Boston, which were held with so much success last spring and in the early summer, would begin on Oct. 18. New blue and white button insignia have been designed for lapel use by section members. The report of the treasurer showed that the disbursements for the year had been about $2,400, leaving a balance on the right side of the ledger. A letter extending good wishes to the gathering was read from Miss Harriet Billings, assistant secretary of the national organization.

THE EDUCATION AND WELFARE OF THE EMPLOYEE.

Mr. Alfred S. Nichols, of the Woonsocket Electric Machine & Power Company, Woonsocket, R. I., then read a paper on the welfare of the employee, emphasizing the present tendencies toward better relations between public and private corporations and their rank and file, and urging the importance of increasing the efficiency and prosperity of the individual worker. A progressive public policy demands that every central station should stand pre-eminent in the community it serves in all that concerns a happy condition of the wage earner. The work of the Stone & Webster Employees' Investment Association was outlined. On June 30 last this association had 1693 depositors, whose savings amounted to $726,056, an average of $428 each. The paper concluded with a description of the Woonsocket Gas & Electric Companies Employees' Club, which holds bi-monthly meetings at which addresses are given upon engineering and operating topics. A technical library of books and magazines is maintained on a co-operative basis, and the results already indicate an improved esprit de corps in the organization.

Discussion.

Mr. H. T. Sands, Tenney companies, Boston, pointed out that welfare plans carried out on sentimental lines were bound to fail. Employees do not care to be considered as objects of charity, and another rock upon which such enterprises often split is the presentation of excessively technical papers which are above the heads of the audience. The education of employees is easier in larger companies on account of the more specialized class of men dealt with in such companies.

The welfare work of the New York Edison Company was then outlined by Mr. F. C. Henderschott, who described the one-year and two-year courses conducted for the benefit of employees. Thirty per cent of the men who enrol finish the curriculum. The objects are improved service to the public and increased individual efficiency, and it is found that the results are better where the men share in the expense. Certificates are given for different grades of work done in the courses. The work is compulsory, written examinations being given, and last year the program consumed 13,350 employee-hours taken directly from business. During this time the number of meter settings increased 20.5 per cent. Out of 314 men eligible to take the courses, 249 enrolled. Twenty-seven men failed to pass at a grade of 75 per cent, the unsuccessful students usually being record clerks and office helpers without adequate preliminary education. In the courses of the second year lectures by men of national reputation are features. Mr. Henderschott said that much of the welfare work done by the larger companies can be applied without difficulty to smaller organizations.

Mr. C. W. Stevens, Lynn, Mass., and Mr. Mullin, Harrison, N. J., both of the General Electric Company, spoke

briefly. The point was brought out that a chance to take the course over again is appreciated by men who fail to pass the first time. Mr. Mullin submitted a printed syllabus describing in detail the educational courses carried on at the Harrison lamp works, outlining the scope of the lectures, reading and laboratory experiments given under the auspices of the company. Mr. C. R. Price, New Bedford, Mass., asked concerning the desirable limits of co-operation on the part of the central-station organization in regard to self-help. Closing, Mr. Nichols said that at Woonsocket about 50 per cent of the men attend the club meetings, and that those who are worth while are bound to take a keen interest in the proceedings. It was his opinion that the company has done its part when it has furnished reading matter, club rooms and courses.

ELECTRIC PROTECTIVE DEVICES.

Mr. C. C. Badeau, Condit Electrical Manufacturing Company, Boston, Mass., presented a paper discussing the general principles of protection by circuit-breakers, oil switches and relays, emphasizing the point that all protective devices should not open except in cases of dire emergency, the maintenance of continuous service being vital in modern practice. The author pointed out that protective apparatus must be selected only after a careful study of the equipment in the system. Such devices must be designed in reference to their continuous current-carrying capacity, with sufficiently low resistance at the contacts to give a rise not exceeding 30 deg. C. A higher rise limits the overload capacity of the switch and also heats the oil and renders it less effective in quenching arcs.

Oil should not be depended upon to handle a poor contact. It is poor policy to purchase for 200-amp service a switch which would be rated at 100 amp in air, but which when put in oil is given the higher rating on account of the radiating surface of the oil can. Purchasers should specify both the rise at contacts and the rise at terminals, so that a poor or insufficient contact with a large rise cannot be hidden by using heavy terminals. For alternating-current circuits carbon-breakers are unsatisfactory, even on low-voltage installations. The oil switch is in most cases cheaper and more satisfactory, and it breaks the arc at the zero point of the wave as well as out of the air. Mechanical strength in the entire oil-switch structure is of great importance. Laboratory short-circuit tests of oil switches seldom equal service performance as an index of switch quality, since the power-factors met in service are apt to differ widely from those in the laboratory. Nowhere is economy so false as in the purchasing of protective devices, whose cost is insignificant as compared with that of the apparatus protected. In the purchase of relays, the damping device should be subjected to the closest scrutiny. Lantern slides of various protective devices of recent design were then shown.

Discussion.

The paper, which was read by Mr. G. A. Burnham, Boston, was discussed by Messrs. T. S. Knight, I. M. Cushing and R. S. Twitchell. The first speaker questioned the wisdom of installing any apparatus which might not open the circuit in extreme emergencies. He pointed out the usefulness of finger-type contacts as well as laminated brush designs, and emphasized the point that no single system will take care of all the requirements of operation. The opinion was advanced that the Merz-Price system is not all that may be desired on the score of simplicity. Mr. Cushing spoke of the improvements in generator design which enable modern alternators to withstand even severe temporary short-circuits without permanent injury. He criticised the use of oil switches for low-voltage work on account of the tendency to obtain poor contacts. A larger contact surface is needed per unit of power carried at low as compared with high voltages. Mr. Twitchell emphasized the value of protracting the break for a short period in order to reduce the amount of energy at the switch in the act of rupturing the circuit. He pointed out the need of more accurate definitions of "capacity" in speaking of switches and their controlled circuits and touched upon the severe short-circuit tests imposed upon circuit-breaking apparatus by the Commonwealth Edison Company, Chicago, and the Cliff Electrical Distributing Company, Niagara Falls, N. Y., within the past year with the object of disclosing all the weak points in operation. Such work is extremely helpful to the designer. In closing, Mr. Burnham reiterated his faith in the laminated brush contact. He held that the finger contact is excellent for breaking a circuit in many cases, but favored the laminated brush on account of its space economies. Regarding the Merz-Price system, he could see no objection to running three or four pilot wires in a cable.

ELECTRICAL DEVELOPMENT ASSOCIATION.

Mr. Zenas W. Carter, Boston, secretary of the New England Electrical Development Association, delivered a terse address describing the aims of the organization, outlined in the *Electrical World* of Oct. 12, page 755. He also spoke at length upon the importance of advertising and explaining the safety, convenience and utility of electrical apparatus to the general public and showed that in recent practice a serious lack of knowledge of even these elementary advantages exists. Thus, for instance, one business man hesitated to install an electric flatiron through a false idea of its possible danger to the operator, and another building a twenty-thousand-dollar house had no realization of the usefulness of baseboard outlets. Again, the public is more interested in learning whether electricity at a stated rate is cheaper than gas than in what the price per kilowatt-hour means in itself. Touching upon the need of more thorough explanation of electrical service and its benefits, the speaker called attention to the fact that there are now 483,906 gas meters and 106,638 electric meters in Massachusetts, and said that until the public is better educated electrically, this proportion will continue to be maintained.

One entire afternoon session was occupied by a lantern-slide lecture on "Transmission Line Construction," by Mr. R. D. Coombs, of the N. E. L. A. committee on overhead-line construction. The lecture consisted of an extensive review of modern practice, including comments upon clearance, cradles, spans, loads, details of construction and features of faulty design. Among the points brought out were the importance of carrying all high-tension lines above the maximum height of a released trolley pole, adequate spacing between high-tension and low-tension lines carried on the same poles, better clearance and protection of dangerous circuits when passing buildings, the avoidance of creosoted cross-arms on account of their tendency to drip, the disfavor into which protective cradles appear to be falling, the economy of spending money liberally for suitable insulators, and the avoidance of long spans on highways. The speaker advocated increasing the spans now customary on low-voltage lines and pointed out that the use of steel and reinforced-concrete poles is not economical on short spans. Sleet must be reckoned in calculating lines for high-tension service in all parts of the country except the Southwest. In some specifications sleet has been provided for as a factor of the diameter of the wire, but this is not borne out by the facts. One-half inch of continuous loading of ice around the wire should be assumed. Metal cross-arms will not compete with wooden arms for low-voltage work for some time to come. Cemented pins are objectionable as they cannot be replaced, and if a thimble is used it is difficult to secure sufficient strength in the bolt. Galvanized steel towers are expensive in comparison with a well-maintained painted tower. The size of bolt used in line construction should exceed ⅜ in., as a bolt of this size is sometimes fractured by a wrench in tightening it. Galvanized towers are not economcal in seacoast and coke regions.

Special reference was made to the use of concrete poles on the Pennsylvania lines West, which are giving satisfaction after eight years of service. The pole steps consist of standard steps screwed into wooden blocks cast in the concrete, at times the iron step being cast in the pole. The usual height is 40 ft. Gains and bolt holes are cast near the pole top, and the poles are reinforced by vertical rods at the corners and intermediate rods at the sides. The poles are usually set by a derrick car from the track.

CHICAGO ELECTRIC-RAILWAY CONVENTIONS.

A successful group of electric-railway conventions was held in Chicago last week under the direction of the American Electric Railway Association and its affiliated associations, including the American Electric Railway Manufacturers' Association, which had charge of exhibits and entertainments. The convention headquarters were in the International Amphitheater on South Halsted Street near West Forty-second Street, and the meetings of the associations were held in the nearby Saddle and Sirloin Club. The attendance was large, the number registered being about 3500, and the collection of exhibits was a large and excellent one.

President Thomas N. McCarter, of Newark, N. J., was unable to attend owing to illness, and General Harries, of Chicago, first vice-president, presided over the deliberations of the parent association. In his presidential address, which was read by Vice-president Allen, Mr. McCarter advocated the increase of the company-sections plan and praised the association bulletin, known as *Aera*. He commended also the general policy of publicity and said that the association has nothing to conceal. The appointment of a permanent representative of the association to be located at Washington, D. C., was recommended.

Mr. James E. Hewes, of H. M. Byllesby & Company, Chicago, read a paper on "Water Power Development and Its Relation to Public Utilities." Among other papers and committee reports presented at subsequent sessions were the following: "Education," Prof. H. H. Norris; "Insurance," Mr. Henry J. Davies; "Publicity," Mr. Arthur Warren; "Welfare of Employees," Mr. J. J. Burleigh; "Taxation," Mr. C. L. S. Tingley; "Joint Use of Poles," Mr. W. J. Harvie; "Electric Railway Securities," Mr. Morrill W. Gaines; "Automatic Rate Regulation," Mr. Oscar T. Crosby; "Public-Service Corporation Finance," Mr. Andrew Cooke.

On motion of Mr. Calvert Townley, of New York, the following resolution was adopted: "Resolved, That it is the sense of this meeting that co-operation between this association and others concerned looking to a reduction in the disputes and litigation over alleged electrolytic damage is desirable." The incoming executive committee of the association will take action on this matter.

Officers were elected as follows: President, General George H. Harries, Chicago; first vice-president, Mr. Charles N. Black, San Francisco; second vice-president, Mr. C. Loomis Allen, Syracuse; third vice-president, Mr. C. L. Henry, Indianapolis; fourth vice-president, Mr. John A. Beeler, Denver. The executive committee consists of the gentlemen named and the presidents of the affiliated associations.

ENGINEERING AND OTHER AFFILIATED ASSOCIATIONS.

A partial report of the proceedings of the American Electric Railway Engineering Association was given last week. Among the subjects discussed were block signals, train operation, buildings and structures, standards, heavy electric traction, power generation, engineering accounting, life of physical property and equipment.

Mr. Martin Schreiber, of Newark, N. J., was elected president of the engineering association, and Mr. H. C. Donecker, who is the secretary of the parent association, was also elected secretary of the engineering association.

The American Electric Railway Accountants' Association discussed a carefully prepared program. Among other things there was a discussion on overhead charges and an important address by Mr. William J. Hagenah, of Chicago, on "Intangible Values of Electric Railways and Their Determination from Accounts." There was an interesting discussion following this address. Messrs. W. F. Ham, of Washington, D. C.; C. L. S. Tingley, of Philadelphia; George Weston, of Chicago; J. J. Burleigh, of Newark, N. J.; F. E. Smith, of Chicago, and others took part. Mr. William M. Steuart, of the United States Census Bureau, addressed the association on "Preparations for the Next Census." A committee was appointed to co-operate with the census bureau on behalf of the accountants' association. Mr. J. H. Neal, of Boston, was elected president of the association.

Among the subjects discussed by the American Electric Railway Transportation and Traffic Association were rules of operation, express and freight traffic, statistical units, etc. Mr. Dana Stevens, of Cincinnati, was elected president of the association.

Sessions were also held by the American Electric Railway Claims Association, formerly known as the Claim Agents' Association. Mr. C. A. Avant, of Birmingham, Ala., was elected president of this association.

The annual meeting of the American Electric Railway Manufacturers' Association was held on Oct. 9. The membership has now reached a total of 349. This association received, as did also the parent association, an invitation to hold the 1915 convention in San Francisco. Members of the executive committee were elected as follows: Messrs. J. L. Replogle, Cambria Steel Company; Cornell S. Hawley, Laconia Car Company; C. J. Mayer, Electric Service Supplies Company; S. K. Colby, Pierson, Roeding & Company, San Francisco; W. L. Conwell, Transportation Utilities Company; Charles C. Peirce, General Electric Company; D. W. Smith, Peter Smith Heater Company; H. C. Evans, Lorain Steel Company.

Full and excellent reports of the proceedings of the associations, with descriptions of exhibits and the general "story" of the convention, were given in the daily edition of the *Electric Railway Journal*, prepared by a large staff, among whom Messrs. H. W. Blake, D. T. Pierce, J. A. Kucera and L. E. Gould were prominent.

PUBLIC SERVICE COMMISSION NEWS.

NEW JERSEY COMMISSION.

The Board of Public Utility Commissioners, acting under the authority conferred upon it by the public utility laws, has undertaken to prescribe uniform systems of accounts for all utilities under its jurisdiction, including electric light and power, gas, water and electric street railway companies. Under date of Oct. 1 the commissioners addressed to the accounting offices of all such companies in the State a circular bulletin setting forth a tentative uniform system of accounts. The general classification embraces five schedules, including balance sheet, fixed capital, income, operating revenue and operating expense accounts.

Hearings on the proposed systems of uniform accounting will be held at Trenton as follows: Water companies, Oct. 22; gas companies, Oct. 23; street-railway companies, Oct. 29, and electric light companies, Oct. 30.

OHIO COMMISSION.

The Hamilton Home Telephone Company has brought suits in the local courts at Hamilton against the Public Service Commission, the American District Telephone & Telegraph Company and the Cincinnati & Suburban Bell Telephone Company in an effort to compel the Bell com-

panies to furnish it long-distance service into Cincinnati. The petition asks that the finding of the Public Service Commission be set aside and a decree entered that the defendant companies must maintain for the plaintiff a continuous service into Cincinnati. This is a continuation of the fight that was begun before the Public Service Commission months ago and marks a final effort of the independents to gain an entrance into Cincinnati, a city which has never had an independent service and apparently has no desire for it. The Cincinnati & Suburban Bell Telephone Company, part of the stock in which is held by the American Telephone & Telegraph Company, has for many years exclusively served the Cincinnati territory.

WISCONSIN COMMISSION.

The application of the Platteville, Rewey & Ellenbury Telephone Company for an order to amend a previous order of the commission so as to make the increased rates provided for therein effective for an individual subscriber as soon as his line circuit was made full metallic was not granted by the commission. According to the original decision, the increased rates were to become effective as soon as the entire system was made full metallic. The petitioner alleged that it would take considerable time to place both city and rural lines upon a full metallic basis and that meantime the revenues under the old rates are insufficient. As a compromise, the company has been authorized to place in effect the rates ordered in the original decision for city patrons at such time as all city lines are made full metallic. The application for authority to impose a penalty for lax payment of bills was approved, but the commission was of the opinion that a penalty charge of 25 cents, as petitioned for, was too high and that 15 cents would be ample for the purpose. The commission called attention to the fact that certain subscribers have been receiving the service of two telephones for the rental price of one, as a result of an early competitive campaign, which is contrary to the provisions of the public utility law. Henceforth the company will be required to receive rental for every telephone on its system in accordance with its published schedule of rates. The commission refused to consider the question of a further increase in rates until the company's accounts are kept in the manner prescribed by law.

MASSACHUSETTS COMMISSION.

The Massachusetts Gas and Electric Light Commission has opened hearings at Northampton upon the appeal of Mayor Feiker for a reduction in the prices charged for gas and electricity by the Northampton Gas Light Company and the Northampton Electric Light Company, subsidiaries of the Massachusetts Lighting Companies of Boston. The board will hear the evidence and arguments in the gas case before taking up the electric case. A supplementary petition has been filed with the board requesting the latter to order the price of street lighting reduced.

FEDERAL COURTS.

In the United States Court of Appeals at Cincinnati, Ohio, late last week Judge Warrington denied the motion of the Cumberland Telephone & Telegraph Company for a continuance of the restraining order against the city of Memphis, Tenn., the Mayor, commissioners and chief of police, to prevent the operation of a telephone rate ordinance passed by the City Council some time ago. The motion of the company to advance the appeal for argument was sustained and the case will be heard on the first day of the November session. City Solicitor Charles M. Bryan, of Memphis, made the argument against the motion of the company for the restraining order, while William G. Grandberg represented the company and presented an argument favoring a continuance of the order. As a result the ordinance regulating rates will remain in effect until some disposition is made of the appeal.

Current News and Notes

COMMISSION FORM OF GOVERNMENT IN SPOKANE.—It is reported that the majority of the citizens of Spokane, Wash., are dissatisfied with the commission form of government, which has prevailed there for about two years. An election has been ordered to pass upon an amendment to the city charter changing back to the old system of mayor and aldermen.

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ST. PAUL-MINNEAPOLIS TIE LINE.—By the recent completion of a tie line between the main station of the Consumers' Power Company at St. Paul and the Minneapolis General Electric Company's transmission line, a connection has been made by which the St. Paul company now receives energy from the St. Croix hydroelectric station of the Minneapolis company.

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SPECIAL DENVER ILLUMINATION.—The regular lighting equipment of Denver was augmented during the "Festival of Mountain and Plain" on Oct. 15, 16 and 17 by over 20,000 streamer lamps along Sixteenth Street buildings installed by the merchants. Fifty thousand 4-cp lamps were used as festoons along Fifteenth, Sixteenth and Seventeenth Streets, the arrangements being in charge of the committee on illumination.

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ORGANIZATION OF PUBLIC UTILITY COMMISSIONS.—The National Civic Federation, 1 Madison Avenue, New York, has just distributed preliminary page proofs of that portion of its compilation and analysis of public utility regulation laws relating to the organization of railroad and public utility commissions. This is printed and distributed to interested persons, subject to subsequent additions, deductions and alterations. This portion of the compilation describes the organization of the Interstate Commerce Commission and forty-three state commissions. It covers such features as the name and constitution of the commission, quorum, oath of office, removal or suspension of members, filling vacancies, qualifications for membership, duties, office hours, records, funds and employees. Mr. John H. Gray is director of investigation of the federation.

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BOSTON EDISON COMPANY ADOPTS NEW RATES.—On Oct. 1 the Edison Electric Illuminating Company of Boston placed in effect a "miscellaneous energy rate" for storage-battery charging, cooking, heating, electroplating, refrigeration, water supply and irrigation, as follows: The first 20 kw-hr. per month, 10 cents per kw-hr.; the next 1980 kw-hr. per month, 3 cents. If a customer agrees to pay a price of 10 cents per kw-hr. for all energy furnished under this agreement and used in certain hours specified from time to time by the company, but not exceeding 500 hours during the year and not exceeding four hours during any one day, this amount to comprise a separate charge independent of the kw-hours billed at the short rates, a further discount will be allowed as follows: Excess over 2000 kw-hr. of monthly consumption, 2 cents. The customer agrees to pay a monthly charge of $5 for the necessary graphic instrument if bills are less than $100 per month. The minimum charge is $12 per meter per annum. The Boston Edison Company has also reduced its minimum charge for breakdown or auxiliary service from $3 per kilowatt to $1 per kilowatt per month, effective on Oct. 1. This charge is based on the setting of a circuit-breaker, so that if the customer exceeds the service paid for his service is automatically disconnected. He may use energy at any of the regular rates up to the minimum without further charge, but in case he exceeds the minimum the energy will be billed at the regular rate applicable in each case.

Hungarian Album for Edison.—In expressing his appreciation of an album presented to him by Hungarian friends, through Mr. Etienne de Fodor, director-general of the Budapest General Electric Company, Mr. Thomas A. Edison stated that: "As a work of art the album is unique and is the acme of perfection to the minutest detail. I have never seen anything of the kind more beautiful." An illustrated description of the album appeared on page 1342 of our issue dated June 22, 1912.

* * *

Boston Street-Lighting Situation.—Mayor Fitzgerald of Boston has addressed a communication to the City Council in which he sets forth at some length his views upon the street-lighting situation and states that he considers the tungsten lamp better than the Graetzin gas mantle lamp in view of the proposition of the Edison Electric Illuminating Company. The latter offers to make a ten-year contract at $18.33 for each 40-cp lamp, compared with $23.60 for the gas lamps. For 60-cp tungsten lamps the company's price is $21.14, and the Mayor points out that this would mean 50 per cent more light for less money than is now charged for the gas illumination of streets. The Edison company further offers to furnish the entire equipment, thus absolving the city from any investment, whereas about $300,000 would have to be appropriated for gas-lighting equipment. The secondary and minor thoroughfares of the city are chiefly involved, the principal streets and squares already being lighted by 6.6-amp magnetite-arc lamps supplied by the Edison company.

* * *

Joint Investigation of Electrolytic Damage.—A resolution favoring a plan of co-operation "looking to a reduction in the disputes and litigation over alleged electrolytic damage" was adopted by the American Electric Railway Association in Chicago on Oct. 10. It was offered by Mr. Calvert Townley, of New York, who, in explaining it, said: "Many of us have had electrolytic disputes in some locations, and those of us who have not had them are doubtless interested in watching their progress. It has, doubtless, been impressed upon the minds of many that there is a large amount of unnecessary disagreement over the elements of the question, over which there should be no disagreement. If an electric railway is attacked in its locality by another corporation having metallic installations, the first thing is to get expert advice on one side and then on another, and the experts will have different points of view, often having disputes among themselves. The newspapers add notoriety to it, and the public get the impression that the electric companies are to blame. There has been an informal discussion going on, started in the American Institute of Electrical Engineers, with a view to getting an expression of this association, the electric light association, the telephone people and gas and water companies as to the appointment of some sort of a joint committee to study the question and see whether or not they can formulate some basic principles of procedure to eliminate these controversies."

* * *

Lightning in Relation to Forest Fires.—Bulletin 11 issued by the Forest Service of the United States Department of Agriculture is entitled "Lightning in Relation to Forest Fires" and contains an extensive study of the subject by Mr. Fred G. Plummer, geographer of the department. The investigation embraces a study of the nature and kinds of lightning, the effects of lightning on trees and soil, the liability of trees to lightning stroke and an analysis of the statistics gathered by the Forest Service during the past five years regarding the kinds of trees most often struck, the fires caused by lightning, the proportion of trees struck which ignite, etc. Observations were made by nearly 3000 forest officers, covering a territory of nearly 2,000,000 acres. The geographic distribution of lightning was also considered. In the summary of conclusions it is stated that trees are objects most often struck by lightning, first, because they are the most numerous of all objects; second, because they extend upward from the ground and shorten the distance between clouds and earth, and, third, because their spreading branches and roots present an ideal structure for dissipating atmospheric electrical charges. Any kind of a tree is likely to be struck by lightning, and the greatest number struck in any given locality will be of the dominant species. If a given tree is taller than those surrounding it, or if it is isolated from other trees, or, again, if it stands on high ground or is deeply rooted, the likelihood of its being struck is increased. Lightning may cause forest fires by igniting a tree which is struck or by igniting the humus at its base, and most of the forest fires caused by lightning probably have their origin in the humus.

* * *

SOCIETY MEETINGS.

Employees' Association at Marshfield, Ore.—Employees of the Oregon Power Company at Marshfield, Ore., have formed an association for mutual improvement. Mr. H. O'Mara, superintendent, was elected president and Mr. D. McIntire secretary of the new association.

* * *

Worcester A. I. E. E.—Mr. C. Eugene Putnam, engineer with the Worcester (Mass.) Electric Light Company, was the speaker of the evening at the October meeting of the Worcester Polytechnic Institute Branch of the American Institute of Electrical Engineers, his subject being "Engineering Problems Connected with the Electrification of Industrial Plants."

* * *

Colorado Electric Club.—At the first Colorado Electric Club luncheon of the season Mr. H. N. Casson, formerly Bell Telephone Company advertising manager at New York, gave a very interesting exposition on "Efficiency in Advertising." The luncheons of the club will hereafter be held at the New Rex, Fifteenth and Curtin Streets, Denver, on each Thursday at 12:15.

* * *

The Telephone and Telegraph Society of New England, Boston Plant Chapter.—The eleventh regular meeting of the Boston Plant Chapter of the Telephone and Telegraph Society of New England will be held on Oct. 15 at 8 o'clock in the auditorium of the Edison Building. On that occasion Mr. J. G. Patterson, of the plant engineering department of the New England Telephone & Telegraph Company, will address the chapter on the subject of "Toll-Line Studies." Mr. Gordon S. Wallace, 125 Milk Street, Boston, Mass., is secretary of the organization.

* * *

Minnesota Section, A. I. E. E.—The first meeting of the Minnesota Section of the American Institute of Electrical Engineers after the summer recess was held on the evening of Oct. 7 at the Ryan Hotel in St. Paul. The meeting was preceded by the usual informal dinner at 6:30 p. m. Mr. Arthur L. Abbott, the newly elected chairman, presided. Mr. Abbott read a proposed amendment to the by-laws of the section providing for standing committees in the Minnesota Section covering the following subjects: Power transmission, illumination, power plants, telephony and railway engineering. Mr. D. L. Galusha, of the Stone & Webster Engineering Corporation, then gave an exceedingly interesting and instructive lecture on the Keokuk hydroelectric development. The lecture was illustrated with lantern slides.

THE JORDAN RIVER POWER DEVELOPMENT—II.

Description of Hydraulic, Generating and Transmission Features of the Vancouver Island Power Company's Plant.

Construction of Dams and Reservoirs, Flume, Pipe Line and Power House—Transmission Line Constructed with Cedar Poles Carrying Steel Cross-Arms—Aluminum Cables Carried on Suspension Insulators.

THE history of the Jordan River development and an account of certain construction details were contained in an article which appeared in the issue of Oct. 12. The present article deals with other features of the hydraulic construction work, the power house and transmission line.

DIVERSION.

Two diverting dams, one in the main Jordan River and one in "Y" Creek, a tributary stream, were installed. Immediately below the junction of "Y" Creek with Jordan River the canyon narrows and a ridge of outcropping bedrock crosses the stream and extends well up the steep slopes on both sides of the canyon, forming a site well adapted for the placing of a concrete or masonry dam. It was originally planned to place the diverting dam at this point, but owing to limited time, the lack of a supply of concrete material nearer than the beach, and further in view of the possibility of utilizing the site for the construction of a high masonry dam, which would, in addition to diverting the stream into the flume, form a large impounding reservoir in the valleys above, this site was reserved for the erection of the more permanent and higher structure at some later time, and a site for the main initial diversion was selected 2000 ft. further up the stream.

The diverting dam on "Y" Creek was built a short distance above its junction with Jordan River, and a branch flume was installed which carries the water down the west side of the stream, crosses the main river on a timber truss 60 ft. long and discharges directly into the main flume.

The main Jordan River diverting dam is a log crib filled with rock resting throughout on solid rock. Rock from the excavation for the intake basin was used to fill the cribs. Timber cut adjacent to the site was used in the construction, the logs being notched and drift-bolted together and thoroughly pinned to the underlying bedrock. The top, upstream and downstream faces of the dam are sheathed with a double thickness of 2-in. plank laid with broken joints. The general dimensions of the dam are:

Length of crest, ft.	127
Top width, ft.	8
Upstream slope	1 to 1
Downstream slope	1 to 1
Maximum height, ft.	18

Three timber headgates, with rack and pinion operating gear, are provided to regulate flow of water into the intake basin, which is also formed of log cribs, back-filled with rock and lined with plank for water-tightness. At the lower end, and immediately above the flume entrance, sand gates are provided, depressed 2 ft. below the flume floor, through which silt and sand collecting in the bottom of the intake basin may be discharged.

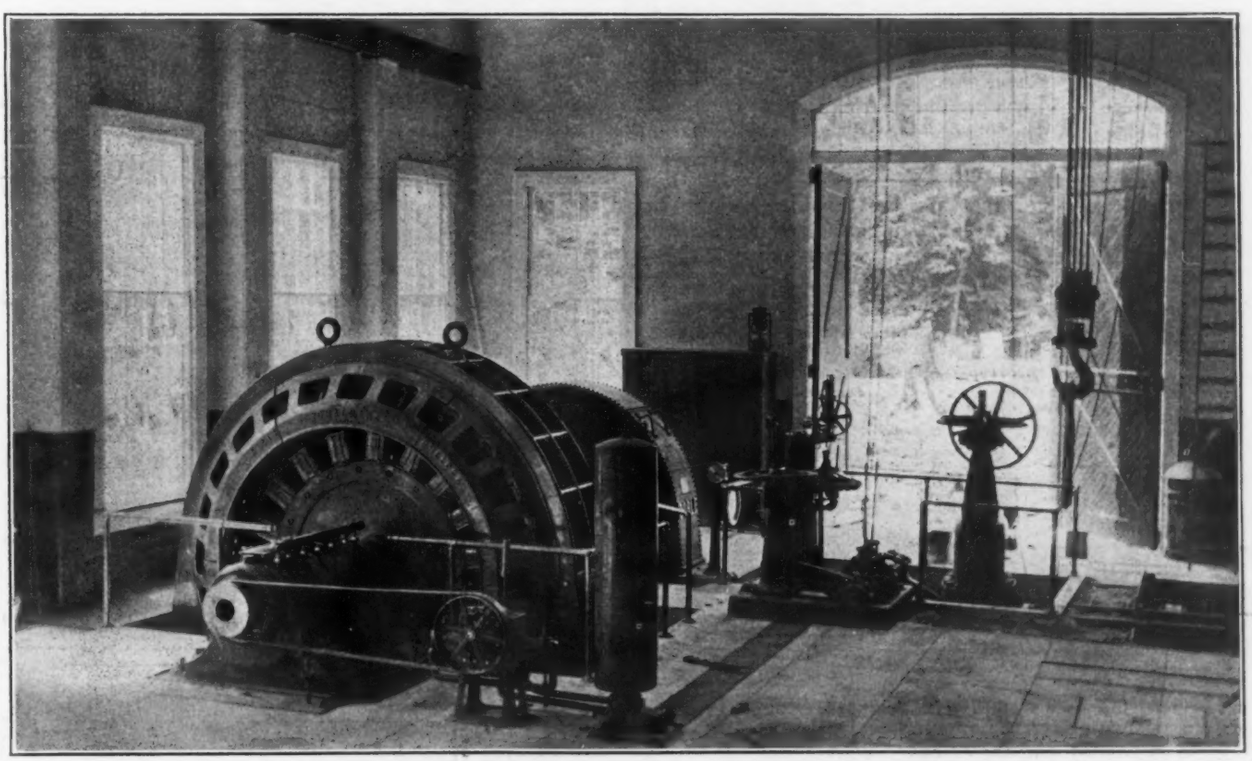


Fig. 8—Interior of Power House, Jordan River Development.

The dam has withstood the floods of two seasons, nearly 8 ft. depth of water having passed over the crest at the highest stage, and at low water the observed leakage is practically nothing. The "Y" Creek diverting dam is similar in type to the main dam already described, the crest, however, being only 90 ft. in length.

Fig. 9—Diversion Dam.

MAIN FLUME.

The main flume follows the south side of the Jordan River canyon for a distance of about 5½ miles. The side of the canyon is precipitous at points, the slope being frequently broken with deep indentations. The formation, as a rule, is stable and favorable for flume foundation, consisting generally of hardpan or solid rock topped with a comparatively thin layer of soil.

The flume traverses a heavy belt of timber along the entire route, and the clearing necessary for adequate protection of the structure was very extensive. A wide clearing was made, all trees being taken down along the upper side which would reach the flume in falling, and all leaning and dead trees were cut along the lower side. The fallen timber was hand-logged down the hill from the zone to be occupied by the flume proper and the flume railway, and the loppings and branches, as far as the season would permit without danger, were piled and burned as the work went forward. About 6,000,000 ft., board measure of timber, were cut in making the clearing.

The flume box, which is designed for an ultimate carrying capacity of 175 cu. ft. per second, is 6 ft. by 6 ft. in size and has a grade of 1 ft. to 1000 ft. It is supported by bents spaced 15 ft. center to center, set upon ample footings, either of cedar blocks or concrete, according to the nature of the underlying material, the maximum bearing upon a square foot of the supporting ground surface being not greater than 1 ton. The number and the dimensions of the various members of the flume are given in the table below.

DIMENSIONS, ETC., OF FLUME MEMBERS.

Members.	Wood.	Dimensions, Inches.	Remarks.
2 bent posts	Cedar	8 x 8	Battened
1 cap	Fir	8 x 8	Gained
2 stringers	Fir	6 x 14	Lapped
6 sills	Fir	4 x 8	Gained
12 box posts	Fir	4 x 6	.....
6 yokes	Fir	4 x 6	Gained

The box is of fir and spruce planking, 2 in. thick, 12 in. and 18 in. wide and surfaced on one side, with flat battens, ½ in. x 3½ in., nailed over the cracks.

Side planks to carry 75 cu. ft. of water per second have been installed, and additional planks may be added as greater capacity is required, at which time intermediate bents, or at least supporting posts, will be installed at the middle points of the stringers, reducing the span to 7½ ft. In the construction of the flume 3,500,000 board-ft. of lumber were used, to supply which a sawmill was erected at the lower end of the flume and adjacent to the forebay reservoir. The capacity of the mill was about 30,000 board-ft. per day, and the equipment included machinery for surfacing, sizing, gaining and trimming the flume lumber for erection with a minimum of hand labor.

The total amount of lumber cut in the mill for the entire construction work was about 6,000,000 ft., board measure. To facilitate the construction of the flume, a 36-in. gage railway, with 20-lb. rail, was built parallel to the flume along its entire length and at an elevation about 15 ft. above it. Lumber and other material for the flume, as well as for the diverting dams and storage dam, were delivered over this track, which connects directly at its lower end with an inclined tramway of the same gage. This inclined tramway begins at a landing wharf on the shore, is 2 miles in length and after overcoming a difference of elevation of 1200 ft. connects with the flume railway near the sawmill. The operation of the inclined tramway is accomplished by means of a powerful haulage engine placed at the upper end of the tramway and a second and lighter haulage engine near the lower end, slight grades at sections preventing the cars from any liability to overhaul the cable by reason of their own weight.

In building the flume all members were sized and cut to true length, including bent posts, and all daps and gains were made at the sawmill by machine. The footings were accurately located and placed to elevation with transit and level, somewhat in advance of the erection. The length of the posts required for each bent was determined and the information forwarded to the framing yard at the sawmill where the various parts were prepared. In this way confusion and crowding were avoided and a greater rate of progress was made possible. The system worked out, on the whole, quite satisfactorily, very few errors occurring in the process.

Five combination sand and waste gates are provided along the length of the flume at approximately equal intervals, and a standard weir was built at the lower end, where several measurements were taken to determine the carrying capacity with different depths of water. The result of these

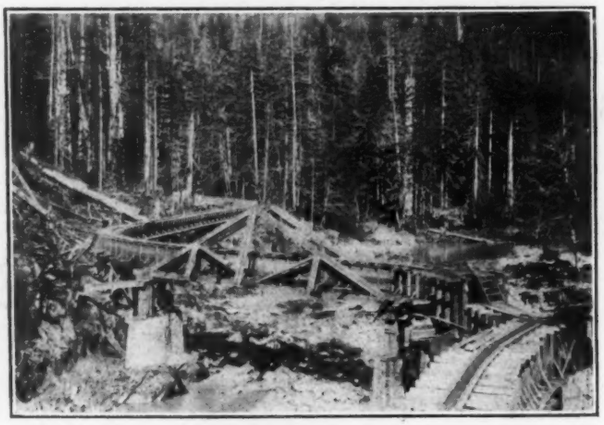


Fig. 10—"Y" Creek Flume and Main Flume Junction.

tests indicates a value of about 122 for the c coefficient in Chezy's formula, $v = c\sqrt{rs}$.

The flume has been in continuous operation since November, 1910, and has proved tight, safe and reliable in every respect, only one short interruption having occurred, this having been due to the loss of one bent destroyed by a small landslide.

FOREBAY RESERVOIR.

The forebay reservoir site consists of two small, gently sloping, heavily wooded depressions leading in opposite directions from a low saddle or ridge lying 1150 ft. above sea level. Two earth dams were built across the valleys, the material for the embankments being all excavated from the higher ground between. Each embankment is about 35 ft. in height and 1000 ft. in length. The total volume of fill in the two dams is 35,000 cu. yd.

The material available for the embankments was semi-cemented gravel or hardpan, which required drilling and blasting to loosen. A double-sheathed timber diaphragm of cedar planking, connecting with a concrete cut-off wall sunk well into the impervious hardpan, was installed in each dam to insure water-tightness, the material from which the dams had to be built not being sufficiently impervious to make them adequately water-tight without the use of diaphragms.

Dam No. 1 was built with wheelbarrows and heavy sleds, hauled with a donkey engine and hoisted and dumped from an overhead cable-way. Dam No. 2 was built under contract, with horses and carts. No particular attempt was made on either embankment to puddle or compact the material during construction, except that a limit of 3 ft. was placed upon the layers deposited and a small amount of puddling with water was done immediately in front of the timber diaphragms.

A concrete intake structure, surmounted by a structural-steel gate tower, from which are operated two roller-bearing 54-in. hydraulic sluicegates, was erected inside the reservoir at the head of the pipe line. Two 44-in. steel-riveted pipes are installed through the base of the south dam. From the intake structure to the core wall the pipes are embedded in a reinforced-concrete casing, and from the core wall to the lower toe of the dam two open culverts, with common center wall and roofed with reinforced-concrete slabs, are installed around the pipes, insuring perfect drainage and allowing access for inspection. Two 6-in. standpipes extending up to the floor of the gate tower are installed at the upper end of the pipes.

The reservoir when full covers an area of about 12 acres, and the capacity available—4,800,000 cu. ft.—is sufficient to operate the single generating unit installed for a period of about thirty hours. To prevent damage to the slopes from wave action, a light timber boom is floated about 4 ft. from the water's edge and braced at intervals from the bank. An

Fig. 11—Pipe Line and Incline Tramway.

emergency spillway with flashboards and apron is built in the solid ground at the east end of Dam No. 2.

The function of this forebay reservoir is to increase the peak-load capacity of the power plant by liberal storage immediately at the head of the pipe line, and also to furnish a reserve supply of water to run the plant for a considerable period in event of accident to the flume.

PIPE LINE.

The pipe line leading from the forebay reservoir to the power station is 9800 ft. in length and follows a gentle slope for the greater part of its length, the lower 300 ft. descending abruptly to the power house. The upper third of the length of this line is designed to deliver water for

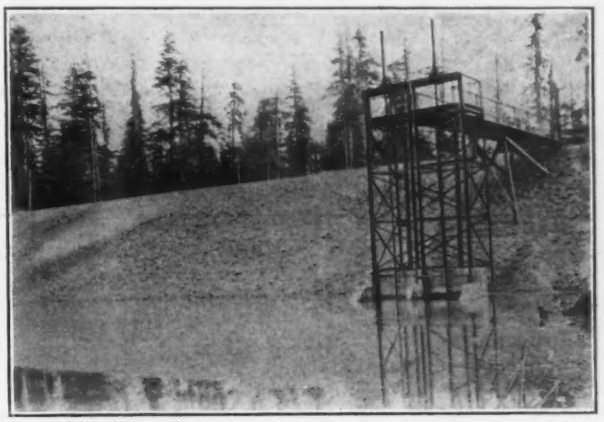


Fig. 12—Intake Tower, Forebay Reservoir.

two generating units of 4000 kw each, and consists of one riveted steel pipe 44 in. in diameter, ¼-in. to ⅜-in. plate. At the lower end of this section a cast-iron "Y" piece, fitted with two 36-in. cast-steel gate valves, is installed, providing for the extension of two lines to the power house. The lower section of the pipe is designed to deliver water for one generating unit only, and the single line installed consists of lap-welded steel, with riveted roundabout joints, in approximately equal lengths of 36-in., 34-in., 32-in. and 30-in. diameter, and varying in thickness from 5/16 in. at the "Y" end to 9/16 in. at the lower end.

The pipe line was designed with an ample factor of safety according to current practice in the extensive use of lap-welded pipe. However, owing to the apprehension aroused in the minds of the officials of the company by a reported failure of a similar lap-welded pipe elsewhere, the lower end of the pipe line for a distance of 2200 ft. was reinforced by 1-in. round steel bands, after the manner of a wood-stave pipe, with spacing from 3¾ in. to 4 in.

Several hours after first filling the line with water the 36-in. valve on the dead end at the "Y" burst without warning and the water in the 44-in. pipe above was suddenly discharged. No damage, however, resulted to the pipe line, ample air openings having been provided for its protection. The valve was split almost centrally through the body and bonnet, the lower half being blown a distance of 20 ft. An investigation of the design of the body showed that an ample section of metal had been provided throughout for a large factor of safety and no flaws or other defects were disclosed. The valve had been ordered tested before shipment, but this had not been done. The accident emphasizes the unreliability of cast iron even for moderate pressures. The cast-iron valve bodies were then discarded, and cast-steel parts were installed in their places, and, as an additional precaution, two expansion joints, one in the 44-in. pipe above the "Y" and one in the 36-in. pipe below, were introduced in the line to eliminate any strains due to expansion or contraction to which the cast-iron parts might be subjected. Eight 4-in. air valves and four manholes were installed along the length of the pipe, and immediately back of the power house a cluster of four automatic pressure relief valves were mounted. Concrete anchor blocks and supporting piers were erected at proper intervals along the pipe line.

The inclined tramway was installed parallel to the line along its entire length, from which the pipe and other materials were delivered. The entire pipe-line installation,

including the furnishing of material and the erection, was done under contract by the Jens Orten Boving Company, Ltd., of London, England.

POWER STATION.

The power station faces the ocean and is erected on low ground at the foot of the pipe-line hill, which slopes very

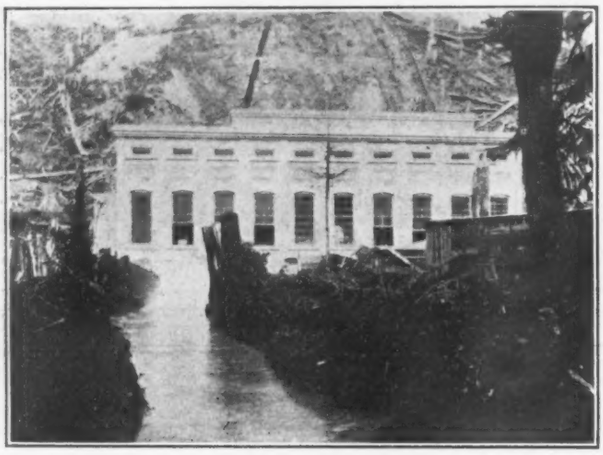


Fig. 13—Jordan River Power House.

abruptly for the lower 300 ft. of its length. The ground surface is elevated only slightly above extreme high-tide elevation, but the waterwheel nozzles are placed 5.5 ft. above the maximum high-tide level. A very heavy growth of cedar, spruce and hemlock timber was removed from the site in preparation for the construction work.

The power-house building is 49 ft. by 97 ft., sufficient space being provided for the installation of two complete generating units, with exciters, transformers, switchboards, low-tension and high-tension switches, etc. Concrete and steel were used exclusively in the construction of the building, account being taken in making the location for its extension to contain an ultimate installation of four generating units.

The pipe line previously described enters the power house at the back and is connected to the generating units through a 24-in. gate valve, there being an effective head of 1100 ft. The water is controlled by a needle regulating nozzle in conjunction with an auxiliary needle nozzle, the needle of which is mechanically connected to the main needle and is so arranged that it opens automatically as soon as the main needle closes rapidly or beyond a certain predetermined point. In this way the auxiliary nozzle maintains a sufficient vent to avoid a dangerous rise of pressure in the pipe line. The auxiliary nozzle is also fitted with an independent slow-moving adjustable time-element mechanism which gradually closes the nozzle when the main needle stops moving, thus conserving the water supply. A Lombard Type Q oil-pressure governor is used for speed regulation and is directly attached to the main nozzle needle.

The main generating unit consists of a 4000-kw generator and a 6000-hp impulse waterwheel. This unit is of the two-bearing type, having the revolving field of the generator mounted on the shaft between the bearings and the waterwheel overhung at one end. The speed is 400 r.p.m. One exciter is installed of a size sufficient to supply maximum field current for two generating units. The extended shaft carries on one end an overhung impulse waterwheel and is connected at the other end to an induction motor, which operates at the generator voltage and drives the exciter generator continuously. The exciter waterwheel is equipped for hand control only, as the motor serves as a speed regulator and no governor is necessary. A four-panel marble switchboard, provided with a complete equipment of instruments and controlling devices, including a Tirrill regulator, is mounted on the switchboard floor, which is elevated about 6 ft. above the generator floor.

The energy delivered by the generator at 2300 volts is stepped up to 40,000 volts by means of three 1400-kva, oil-insulated, water-cooled transformers, which are installed in fireproof compartments back of the generator. These transformers are now operating with delta connection, delivering current to the transmission line at 40,000 volts. This voltage will be raised upon the installation of the second unit to 60,000 by changing the delta connection to star connection with grounded neutral.

The waterwheel equipment was furnished by the John McDougall Caledonian Iron Works, Ltd., of Montreal, and manufactured under the Doble patents; the generator and exciter by the Allis-Chalmers Bullock Company, Ltd., and the transformers, switchboards, switches and lightning arresters by the Canadian General Electric Company, Ltd.

A 75,000-volt, three-pole oil switch with disconnecting switches, arranged for hand operation from the generator floor, is installed in the high-tension room. A complete equipment of aluminum-cell, three-phase, 40,000-volt lightning arresters has been provided to protect each end of the transmission line.

SUBSTATION.

At Victoria the substation used in connection with the operation of the transmission line from the old Goldstream hydroelectric station has been utilized. Extensive alterations were made in the old building, including the erection of transformer stalls for two banks of transformers and a high-tension switchroom of reinforced concrete, space being provided for bringing two transmission circuits into the building.

An unfortunate and very unusual set of conditions were encountered in the power-station foundations, the remedying of which was fortunately taken in hand in time to prevent serious delay in putting the plant into operation.

In the construction of the building and the setting of the foundation unusual precautions were observed. The excavations for the foundation walls and the machine setting were carried to a depth of about 21 ft. below the floor level. Some seams of peat varying in thickness from 2 in. to 2 ft. were encountered. At the bottom of the trench a fairly

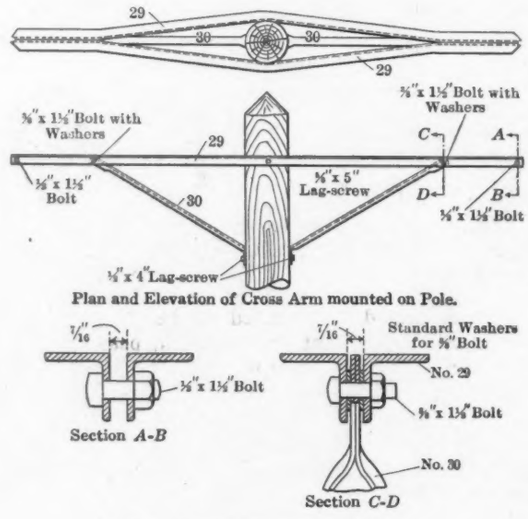


Fig. 14—Details of Cross-Arm.

stiff, blue, sandy clay was found, into which borings were made for a distance of 12 ft., showing the same class of material throughout this distance. Tests of the bearing power of the ground were made, which showed that a load of 5 tons per square foot would not cause any settlement. Having taken these precautions in predetermining the bearing power of the soil, it appeared that this material was

entirely safe for foundation purposes with the load to be imposed.

After the building was completed observations taken indicated that a slight settlement was taking place. These observations were continued for several months in order to establish beyond a doubt that the building and machinery foundations were actually settling and to determine as nearly as possible the rate of settlement.

In June, 1911, a series of test holes were put down at points around the building, which showed that a soft muck bed from 5 ft. to 15 ft. in thickness lay some 50 ft. below the floor level and about 25 ft. below the bottom of the foundations. The layer of clay on which the foundations were set had been stressed beyond its supporting power and had gradually compressed the stratum of muck and peat beneath.

This most extraordinary condition could not have been found by any means of testing other than sinking deep drill holes, and even if this had been done previous to the settling of the building, the strength of the clay seam could not have been determined by any test except the application of a load approximating the entire weight of the structure and contents, which was, of course, impracticable. Only such a weight would have caused the bending of the clay stratum and the consequent yielding of the peat seam.

In the course of the original investigation test piles 45 ft. in length were driven adjacent to the power house, the bearing power of which, computed from the penetration under the hammer blow, was from 12 tons to 15 tons per pile. It is evident that if a pile foundation had been installed with piles driven to apparently ample depth based on penetration the condition would not have been discovered in advance or the settlement obviated.

The underpinning of the machine foundations was begun July 15, 1911, and carried on continuously night and day until Sept. 10, when the plant was put in operation. Standard pipe or casing 12 in. in diameter was sunk with well rigs to the bedrock beneath the peat seam around the machine foundation and pipe line immediately behind the power house. The pipes were pumped out, cleaned and, after inserting steel reinforcing bars, were filled with concrete, forming a system of some twenty-six steel and concrete piles. Steel I-beams were placed on top of the piles supporting the concrete foundation, wedges being driven as tightly as possible between the tops of the beams and the concrete of the foundation, and the whole was surrounded with concrete. No settlement has been observed since the completion of this underpinning. The building foundations proper were not strengthened, and no settlement has taken place since the clay stratum was relieved of the weight taken by the piles.

TRANSMISSION LINE.

The transmission line leading from the power station to the city of Victoria traverses the rough, heavily timbered country along the west coast of the island for a distance of about 40 miles. The first 15 miles of its course is located along the bluff shore line of the Straits of Juan de Fuca, the wires in some places overhanging the sea. No road or trail existed along this section at the time the line was built, and the materials, except poles, which were cut from the adjacent forest, were delivered by small boats along the beach. The remaining 25 miles of the line follows generally the provincial government highway, with more or less diversion to avoid acute angles and to shorten the distance. The current is transmitted at 40,000 volts, three-phase, 60-cycle.

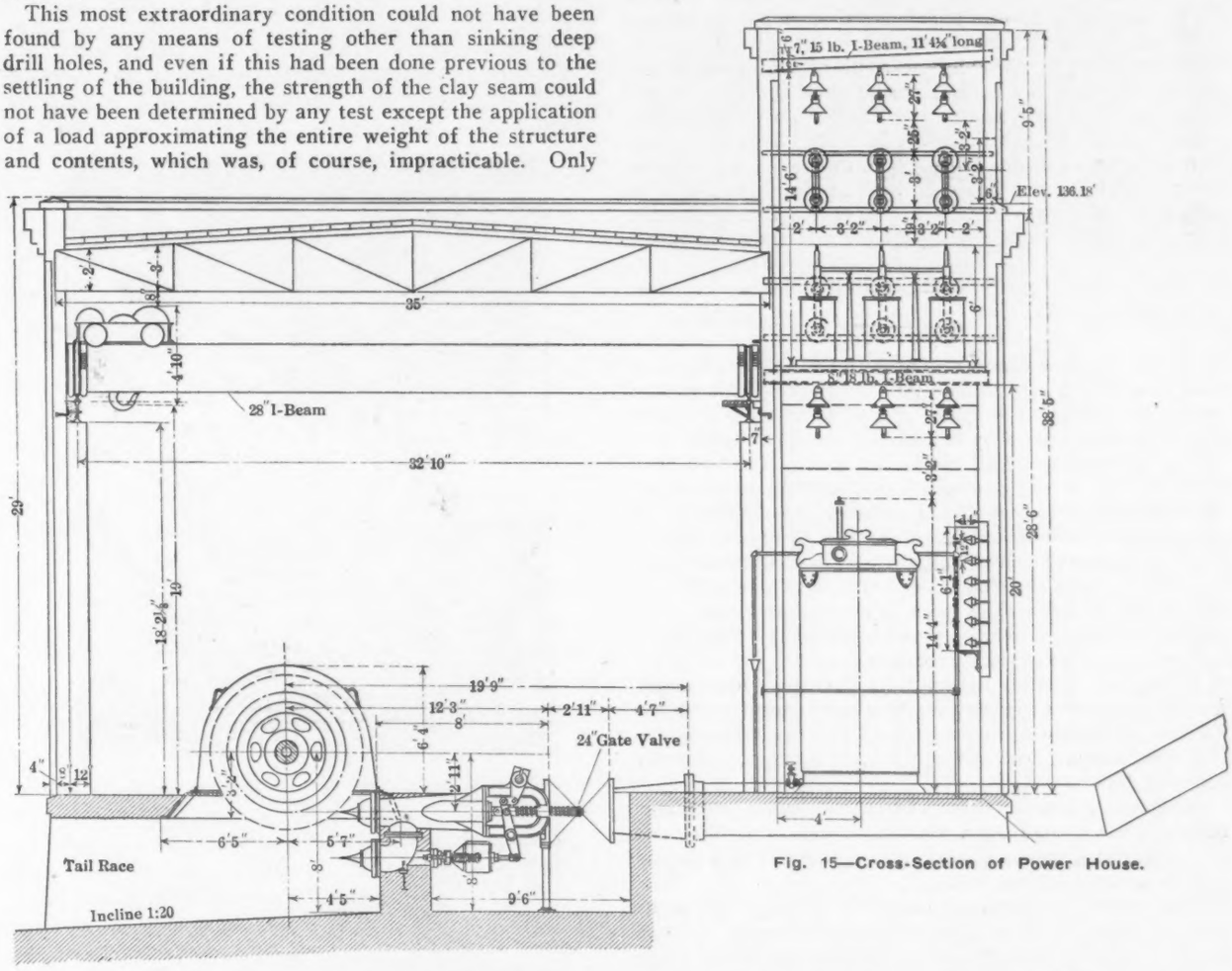


Fig. 15—Cross-Section of Power House.

Cedar poles (with a minimum diameter at the top of 9 in.) are used throughout, 50 ft., 55 ft. and 60 ft. in height and spaced from 300 ft. to 400 ft. apart. Three steel galvanized cross-arms, each composed of two 1¾-in. by ¾-in. angles 9 ft. long with 1¼-in. angle-iron braces, are mounted on each pole, all bolts, lagscrews and washers being gal-

vanized. The initial circuit is hung on one side of the pole, leaving space on the other side for the installation of a second and similar circuit at some future time. Brown-glazed two-piece suspension insulators, Locke type No. 275, are used, one element only being installed for ordinary suspension. At dead-end angle points two elements are used in order to avoid trouble in adding the second element when the line voltage is raised to 60,000 volts upon the completion of the second unit. Dead ends have been made at all angles where the conductor is drawn toward the pole. Standard line insulators are used on either side of the cross-arm, and the conductor is taken across in a suspended loop.

The conductor is seven-strand aluminum cable No. 00 B. & S. gage and is designed to transmit the output of one generator at 40,000 volts and that of two generators at 60,000 volts. A metallic-circuit telephone line No. 9 B. W. G. galvanized-iron wire is installed on a short wooden cross-arm below the main circuits.

The timber growth along the route of the line is exceptionally heavy, and a very extensive clearing was necessary along and on either side of the line for its protection, all trees that could reach the wires in falling being cut down. For many miles a zone from 400 ft. to 600 ft. in width was cleared through the finest fir belt on the island, and an aggregate of approximately 20,000,000 ft., board measure, of merchantable timber was paid for and cut down in the course of the work. Some of this may perhaps be put to profitable use before becoming useless by decay or being destroyed by fire.

TRANSPORTATION.

One of the most formidable problems of this development was that of transportation. All machinery, cement, pipe, provisions and other supplies, as well as all kinds of labor, had to be transported by sea from Victoria 45 miles down the coast to the mouth of the Jordan River. The Straits of Juan de Fuca at this point are exposed to the sweep of the open sea from the west, and there was no pier and no natural or artificial protection at the point of landing. Bulky freight was loaded on scows at Victoria and towed by a small tug to the Jordan River. The scows on arrival at the Jordan River landing were hauled up on runways laid on the flat beach until they were out of reach of the waves and were then unloaded by derricks.

Making the journey to and from Victoria and beaching the loaded scows in stormy weather were precarious in the extreme, requiring a high degree of patience, courage and skill. Passengers, mail and light freight were landed on the beach in dories.

Although much trouble and some minor accidents occurred, not a single piece of the 6400 tons of material and equipment handled nor a single one of the several thousand passengers carried was lost.

From an engineering standpoint the development in its present initially completed state perhaps presents by itself no very unusual features. But when consideration is given to all the elements involved in carving out of a wild, remote and almost impenetrable and trackless wilderness a reliable and highly efficient hydroelectric system, planned for large expansion along accurately predetermined lines, this development is seen to have very unusual interest. Very few hydroelectric developments have presented a greater aray of formidable obstacles, many closely concealed, and few have been carried through to successful completion on lines so closely adhering to those originally planned, despite the meager data on which these original plans were based.

The entire work was under the direction of Mr. Wynn Meredith, of Sanderson & Porter, from the first pioneering to the final completion of the initial installation of the first 4000-kw unit. The preliminary reconnoissance and surveys were under the immediate charge of Mr. A. B. Carey. The final location surveys and all construction work were under the immediate charge of Mr. E. E. Carpenter, to whom we are indebted for the data forming the basis of this article.

NEW STREET LIGHTING IN CHICAGO—II.

Rehabilitation of Old Lighting System—Location and Design of the New Substations—Conclusions.

As mentioned in the preceding article, the electricity used for street lighting in Chicago is generated by the Sanitary District at its hydroelectric plant at Lockport, transmitted 30 miles to a terminal station at Thirty-first Street and Western Avenue, Chicago, and from there distributed underground at 12,000 volts to a number of substations.

The old lighting system operated from these substations embraced about 12,200 arc lamps of more than twenty-six different makes and styles. The oldest of the stations still in use operate direct-current arc lamps by means of series arc machines belted to line shafts driven by 1200-hp synchronous motors. The plan is now to discard all the direct-current equipment, put in transformers and constant-current regulators and rearrange the lamp circuits for seventy lamps instead of the present 140. A number of small substations located in fire-engine houses will be abandoned, and the circuits will be operated from new stations of larger equipment. The station equipment which will be used in changing the old stations over is the same as that in the new stations now under construction and will be described later.

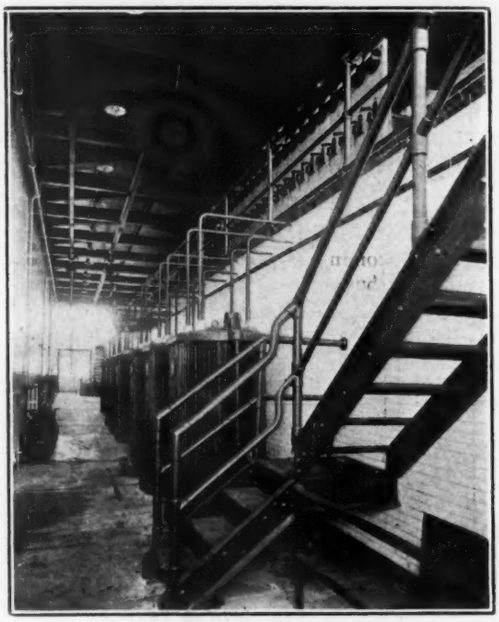


Fig. 8—View in Substation, Showing Transformers and Switch-Board.

SUBSTATIONS FOR NEW LIGHTING.

In addition to this rehabilitation of the old electric lighting system, work is now in progress to light electrically large sections of the city which have heretofore been lighted by gas or gasoline. Four new substations have been built or are now under construction to take care of these new lamps. The locations of the stations and the boundaries of the territories lighted from each station are as follows:

Wabansia Avenue Substation.—Located at Hamlin and Wabansia Avenues, supplying energy for the territory north of Madison Street between California Avenue and the western limits of the city.

Twenty-second Street Substation.—Located at West Twenty-second Street and Spaulding Avenue, supplying the territory bounded by the west fork of the South Branch of the Chicago River, Western Avenue, Madison Street and the western limits of the city.

Thirty-ninth Street Substation.—Located at East Thirty-ninth Street and Lake Michigan, serving the territory from Sixteenth Street to Sixty-third Street east of State Street.

Byron Street Substation.—Located at Byron Street and East Ravenswood Park, serving the territory from Diversey Boulevard to the northern limits of the city and from the river to the lake.

The greater part of these territories will be lighted with flaming-arc lamps, but in some of the residence districts served by the Thirty-ninth Street and Byron Street stations, where the citizens have objected to high-candle-power units and to overhead distribution, a system of series tungsten lamps is being installed. (See preceding article.) The total number of lamps which the Sanitary District so far has contracted to install is 10,000 arc lamps (or their equivalent in tungsten lamps), but the city may call for another 10,000 or 20,000 lamps if the present demand for more lighting persists.

DESIGN OF SUBSTATIONS.

Reproductions are given here of three photographs taken in the Wabansia Avenue substation. They are typical of all substations. Fig. 8 shows the transformers and a glimpse of the switchboard above; Fig. 9 is a view in the regulator room, with the cable pit for outgoing circuits showing in the foreground, and Fig. 10 is a picture taken in the switchboard gallery, with the oil-switch compartments on the right.

Referring to the drawings, Fig. 13 is a plan view of one-half of a substation. The main 12,000-volt bus is located on the balcony near the side wall and runs the whole length of the building. Remote-control switches, manufactured by the General Electric and Westinghouse companies, are here provided for incoming and outgoing lines, for transformer banks and for a bus-tie.

Figs. 12 and 15 show details of brickwork. The transformers, manufactured by the Pittsburgh Transformer Company, are located on the main floor. They are of the single-phase, oil-cooled, core type, rated at 250 kva, with

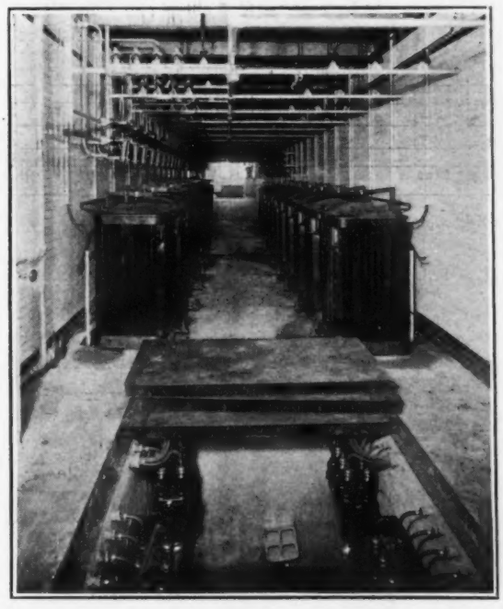


Fig. 9—View in Substation, Showing Regulators and Potheads for Outgoing Circuits.

primary voltages of 12,000, 11,500, 11,000 or 10,500 and secondary voltages of 5050, 4650 or 4250.

While the common American practice in installations of this character is to keep each transformer separate, the city of Chicago has been operating for a number of years with banked transformers, and this method is being maintained for the new stations. The connections are delta on the high-tension side and star with grounded neutral on the low-tension side.

SUBSTATION WIRING.

In Fig. 11 an end elevation of a substation is shown. From the primary and secondary transformer terminals heavily insulated leads go through the wall supporting the balcony into the high-tension room. Here the delta and

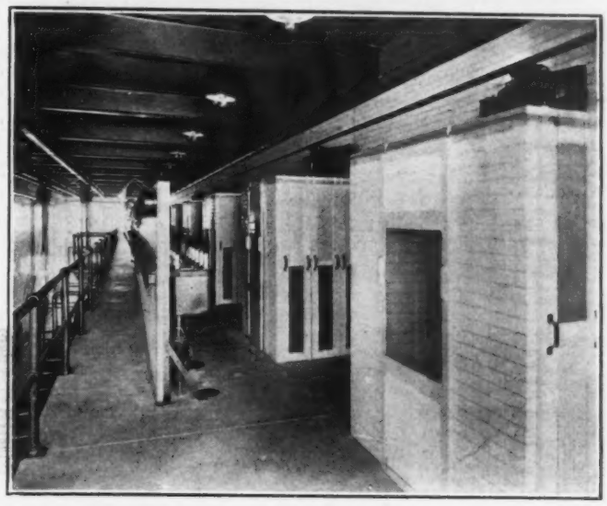


Fig. 10—Switchboard Gallery with Oil-Switch Compartments.

star connections are made up by auxiliary buses of copper tubing supported in the usual manner on pipe racks. Below these buses can be seen the main arc-lamp bus, a plan view of a portion of which is also shown in Fig. 14. The bus runs along the inside wall of the high-tension room, crosses over at the rear end of the building, at which point sectionalizing knife switches are installed, and doubles back along the outside wall. The arc circuits are taken off from the three phases in regular rotation. Having passed the disconnecting switch and an oil switch, each circuit goes

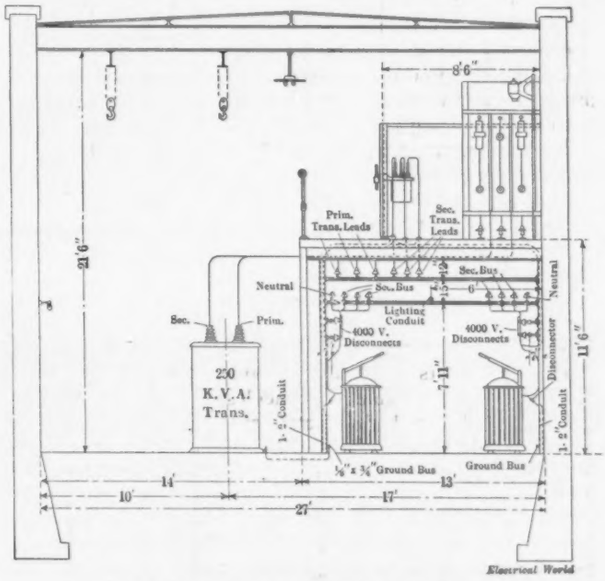


Fig. 11—Cross-Section of Typical Substation.

through a constant-current regulator and leaves the building underground by single-conductor or eight-conductor cable.

OIL-INSULATED REGULATORS.

The regulators, built specially for the Sanitary District by the Fort Wayne Works of the General Electric Company, present some novel features. They can be classified as

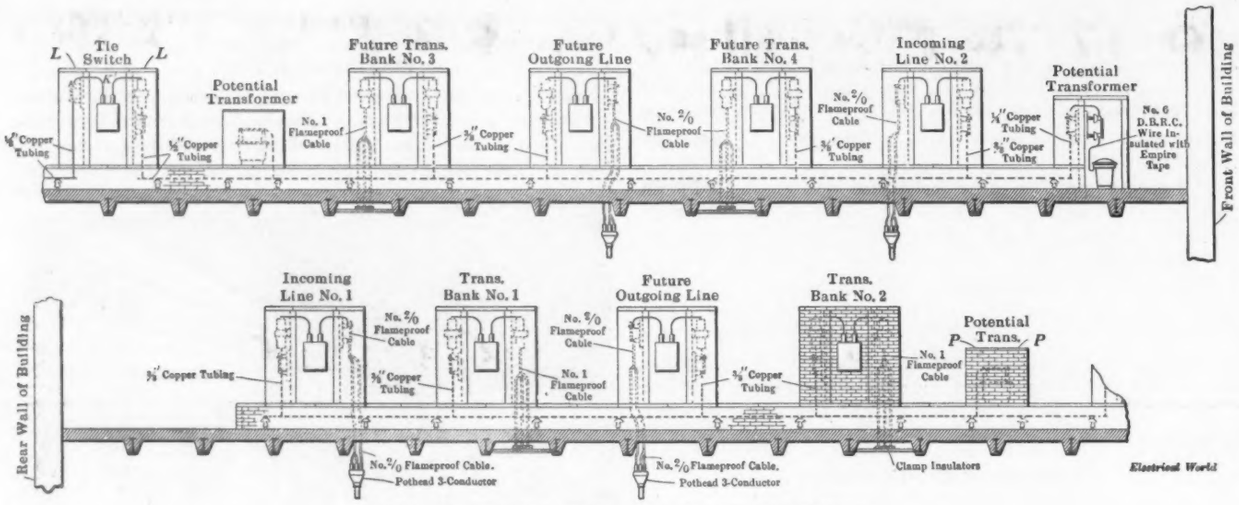


Fig. 12—Elevation of Bus Structure in Substation.

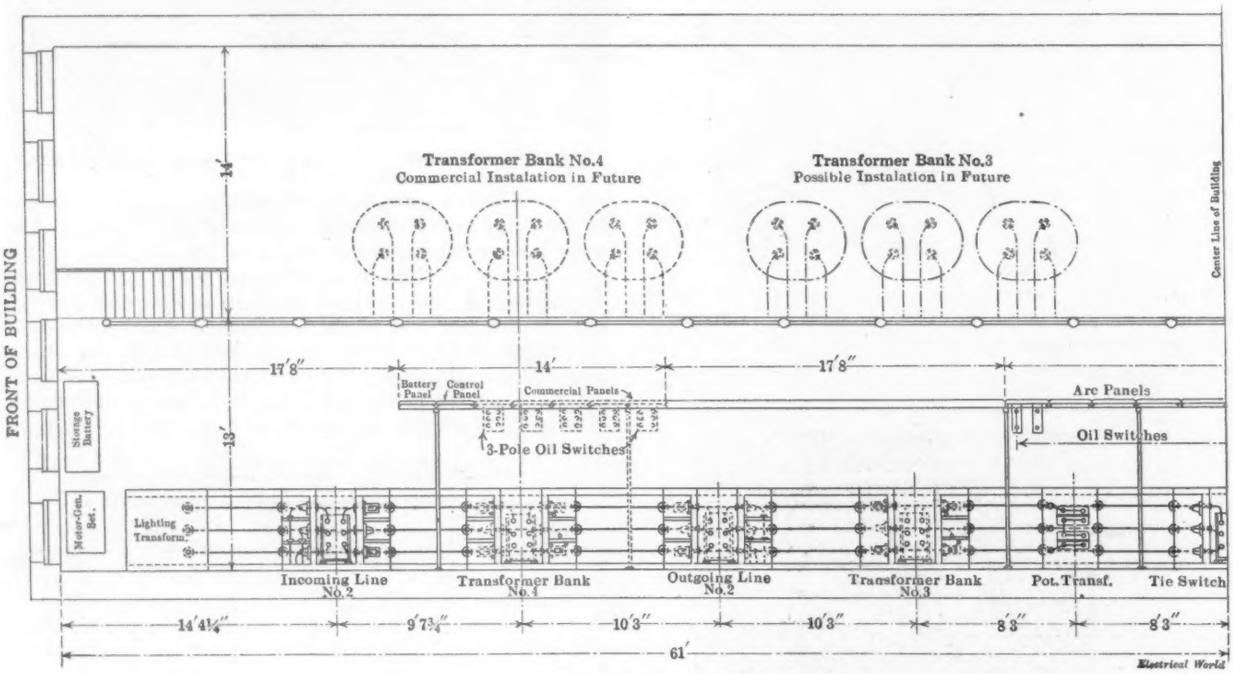


Fig. 13—Plan of One-Half of Typical Substation.

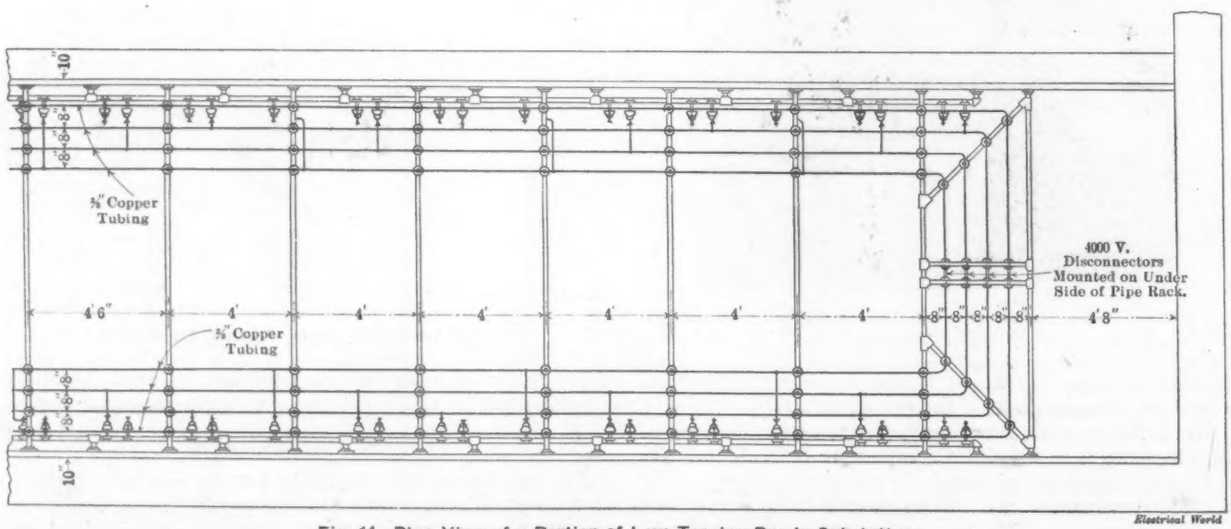


Fig. 14—Plan View of a Portion of Low-Tension Bus in Substation.

single-winding, 60-cycle, 5000-volt, 10-amp regulators and will maintain a practically constant current without excessive heating on a full short-circuit. The regulators are incased in corrugated, oil-filled tanks with cast-iron covers and bases. A steering rod, which comes out through a hole in the cover, serves, in connection with a lever hinged to the case and a hook, for fixing the regulator in the starting position. When the current is thrown on, the regulator is released automatically. As the regulator leads are provided with special connectors and as the oil tanks stand on casters, a defective regulator can be replaced in less than five minutes.

SWITCHBOARD.

The switchboard is placed on the balcony facing the transformer banks and is composed of the following panels:

One main control panel with one horizontal edgewise alternating-current voltmeter, scale 0-15,000 volts, which, by means of an eight-point potential receptacle and a triple-pole double-throw knife switch, can be connected to indicate the pressure in any phase of either section of the 12,000-volt bus. On this panel are located five pull-button control switches with red and green flush-board indicating lamps for incoming and outgoing 12,000-volt line switches and bus-tie switch.

One station service panel with necessary instruments, switches and automatic safety devices for controlling a 100-amp-hour storage battery and a 3-kw motor-generator charging set.

Two transformer panels each equipped with a pull-button control switch for the high-tension switch of the banks, with red and green flush-board indicating lamps, a triple-pole, single-throw, hand-operated automatic oil switch for the low-tension side of the bank, a polyphase printing watt-hour meter and a polyphase curve-drawing wattmeter, both of these meters being energized by instrument transformers, these transformers of course being installed on the high-tension side of the bank.

Twenty-six arc circuit panels are provided for the control of fifty-two arc circuits. The equipment on each panel consists of two single-pole, single-throw, hand-operated, automatic Hartman oil switches, two Roller-Smith round-pattern ammeters and two series transformers with ratio 3:1 for trips and ammeters.

DETAILS OF SUBSTATION BUILDINGS.

The building is a fireproof brick structure, 30 ft. by 125 ft. by 22 ft. high, with Bedford stone trimming, steel frame and concrete floors and roof. The window frames and sashes are of copper, and the windows are polished plate wire glass. The building is finished inside with white and green enameled brick, which material is also used for the bus and switch compartments. It is equipped with a hot-water heating system. Although there was no attempt at elaboration of design on account of limited appropriation of money, the appearance of the building is neat and attractive and in entire harmony with the purpose for which it was constructed.

CONCLUSION.

The rehabilitation and extension of Chicago's electric street-lighting system is probably the largest work of the kind ever undertaken at one time, and it is being carried out by the electrical engineer of the Sanitary District, Mr. E. B. Ellicott, who has collaborated with the former city electrician, Mr. William Carroll, and the present city electrician, Mr. Ray Palmer. By aiding the development of the new long-burning flame-arc lamp and by other new ideas of station and line construction, Mr. Ellicott has contributed to the art of street lighting.

Mr. Ellicott was assisted in the work by Mr. G. S. Brack, who designed the electrical part of all the substations; by Mr. F. L. Barrett, who designed the buildings, and by Mr. H. C. Gilbert, Jr., superintendent of construction, who carried out all the underground line construction with Sanitary District labor and supervised the overhead-line construction and substation construction, which was performed by outside contractors.

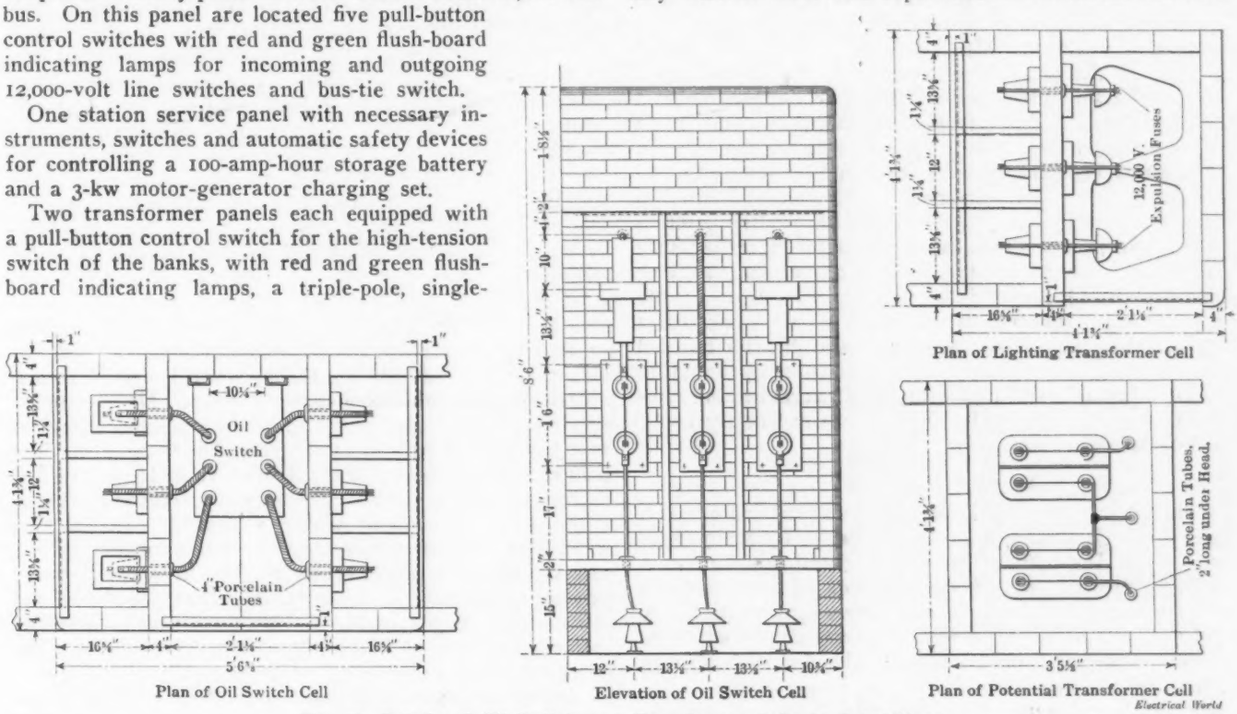

Oil Switch
4" Porcelain Tubes
Plan of Oil Switch Cell
Elevation of Oil Switch Cell
12,000 V. Expulsion Fuses
Plan of Lighting Transformer Cell
Porcelain Tubes, 2' long under Head.
Plan of Potential Transformer Cell
Electrical World

Fig. 15—Details of Oil-Switch and Transformer Cells in Substations.

USE OF MIRROR IN WATCHING STACK SMOKE.

St. Louis has a strict smoke-prevention ordinance, and the fireman who shovels coal carelessly, with consequent clouds of black smut from the stack, is likely soon to find the firing aisle blocked by a couple of bluecoats with shining nickel-plated stars. The ordinance has been of assistance to the Union Electric Light & Power Company in transferring isolated plants to its care, where they receive scientific, intelligent supervision. For instructing its firemen in proper coaling methods at the old Imperial district-heating plant, Tenth and St. Charles Streets, a 36-in. by 36-in. plate-glass mirror has been mounted on a framework in the yard outside the boiler room, so that the top of the smokestack can be seen from any point in front of the boilers. Ringelmann's charts of smoke density are posted conveniently near, and the fireman can take observations from time to time without leaving his station.

STEEL MILL ELECTRICAL ENGINEERING.

AMONG the subjects of interest discussed at the recent Milwaukee convention of the Association of Iron and Steel Electrical Engineers were motor construction and characteristics, welding and safety. Abstracts of papers dealing with these subjects are given below. A news account of the convention and abstracts of many of the papers were given in our issues dated Oct. 5 and 12.

WINDINGS AND INSULATION.

Mr. H. C. Specht's paper, "Windings of Electric Machines," read by Mr. H. L. Barnholt, contained a discussion of points of motor construction for the severe duty of industrial operation. Possibility of repair is always an important factor to mill purchasers. For motors running in clean, dry places, free from shock or vibration, the question of repair is less vital. But in mills, mines, etc., where the machines are subject to vibration, shocks, moisture, dirt, etc., break-down of windings occasionally occurs, and every care for quick repair should be taken. The author discussed diamond-shaped and concentric coils, rectangular and round conductors, choice of wire sizes, etc. Mr. T. E. Tynes referred to the possible advantages of the diamond-coil construction for mill motors. Mr. G. W. Richardson said his experience showed break-downs between commutator bars to be really more frequent than coil-insulation failures.

"Effect of Temperature on Insulation" was the subject of a paper by Mr. C. E. Skinner, Westinghouse Electric & Manufacturing Company, Pittsburgh, Pa. After pointing out the dependence of machine operation on temperature rise, the author exhibited deterioration curves for insulating materials heated above 85 to 90 deg. C. Most of the materials which successfully withstand higher temperatures lack insulating properties. As examples of this rule he cited asbestos, mica, etc. Certain synthetic gums lately developed give promise, however, of meeting both electrical and temperature requirements. Mr. T. E. Tynes and others spoke briefly in the discussion.

MOTOR FIELD COILS.

"Direct-Current Motor Field Coils" was the subject of a paper by Mr. R. B. Treat, Crocker-Wheeler Company, Ampere, N. J. The author described in detail the characteristics and requirements of various kinds of field windings for continuous, uniform-load and reversing operation. A tabulation was added showing the most desirable windings for various special duties about steel mills and blast-furnace plants. In the discussion, Mr. F. D. Egan, Midland, Pa., spoke of the advantages of employing standard motors, since repairmen cannot be relied upon to use the exact ratio of shunt and series windings when making replacements. Mr. C. W. Parkhurst also testified that where a heavy series and light shunt winding is theoretically required, the practical solution is a straight series motor, since the shunt cannot be relied upon. Mr. M. A. Whiting, Schenectady, N. Y., described an arrangement of bypassing the shunt field from the armature circuit. In reply to an inquiry from Mr. E. C. Bedell, Mr. Treat admitted that while control by variation of the air-gap might afford best operating characteristics, the mechanical disadvantages of this method give preference to the scheme of weakening the field electrically, which is simpler and permits of remote control. Mr. T. E. Tynes lamented the manufacturers' practice of giving an excess rating to motor frames when equipped with commutating poles.

CONTROL OF FURNACE TAPS.

Mr. A. E. Handy's paper, "Blast Furnace Tops," read in his absence by Mr. E. C. Smith, Harrisburg, Pa., described the hoisting, elevating and distributing equipment, with automatic electric control features, built by the Otis Elevator Company, for charging blast furnaces with coke, ore and limestone. Mr. T. E. Tynes, Buffalo, N. Y., spoke of the segregation of material according to size when dumped from one point, necessitating rotation of the furnace top to secure distribution. He also described the use of a slack-cable switch, in series with a switch at the bottom of the pit which the operator must hold closed until the car passes a given point in its ascent. Mr. B. W. Gilson, Youngstown, Ohio, spoke of his use of two electric tops which have recording ammeters in the motor circuits, indicating time and load of each ascent. Mr. C. Pirtle, Cleveland, described the controller arrangement in use at the Edgar Thomson works, Braddock, Pa., which rotates the top 90 deg. for each of seven skip loads, then remains stationary for seven loads, after which it again rotates. Recording switches and lamps show position of the top, the distribution being under manual control if desired.

ARC AND OXYACETYLENE WELDING.

Mr. J. F. Lincoln presented a paper describing the electric welding outfit built by the Lincoln Electric Company, Cleveland, Ohio, which has a wave-wound armature on which is superimposed a series field on interpoles between the main poles. The field which generates the arc current is thus weakened by the current in the series coils. Mr. Frank Warren's paper, read by title only, described the equipment of the Toledo Electric Welder Company, Cincinnati, Ohio. Jaws hold the parts to be welded and press them together, while a heavy current across the junction heats them to a fusing temperature. The frame of the machine includes the transformer, the secondary pressure of which is only 5 volts. Mr. M. S. Plumley's paper on oxyacetylene welding was read by Mr. J. M. Morehead, Chicago, who explained the numerous and varied uses of the intensely hot flame for welding and cutting metals. In the joint discussion, Mr. R. F. Patterson, McKee's Rocks, Pa., referred to the use of a magnet coil for holding the molten metal while welding or flowing on vertical or inverted surfaces. Mr. B. W. Gilson pointed out that hammering a weld may weaken it unless the temperature is exactly right. Mr. B. Wiley referred to the reconstructed home-made welding machines found in many repair shops. A contribution by J. A. Seed pointed out the freedom of arc welding from dangers of fire. explosion or asphyxiation. The carbon present in acetylene, it was added, sometimes produces very hard welds. Mr. T. E. Tynes found electric welding of compression parts a success, but had experienced trouble in joining pieces exposed to alternate stresses. He uses from 500 to 600 amp at from 70 to 80 volts. Mr. C. Pirtle, Cleveland, suggested the use of a pinch of Thermit in making heavy welds. The electric arc can be reversed to deposit carbon and give a hard weld if desired, he declared. Mr. Wilfred Sykes spoke of the danger to workmen's eyes from the electric arc, unless properly protected. He recommended double ruby glass. Mr. George Hills, Garwood, N. J., spoke of the early history of electric welding, and described apparatus arranged with resistance which is automatically inserted in the arc line in case of short-circuit. He showed how preheating should be done, not confining it alone to the region of the weld.

SPEED REGULATION FOR FLYWHEEL MOTORS.

The advantages of automatic regulating apparatus for flywheel motors in rolling mills, to cut in and out the slip resistance at various parts of the operating cycle, were discussed in a paper by Mr. E. J. Cheney, General Electric Company, Schenectady, N. Y. Such automatic regulation tends to reduce even further the peaks of the rolling-mill load. The high speed of operation necessary in this control apparatus is effected by a combination of alternating-current contactors direct controlled by speed relays, the number of notching points being reduced to the minimum. Mr. Cheney exhibited curves showing the actual operation of the system, and showed circuits of the apparatus installed with two notching points.

Mr. C. S. Lankton, Pittsburgh, Pa., advised the use of slip regulation if set high so as to afford protection in case

of jam. Mr. C. E. Bedell, Warwood, Pa., said that a 200-hp motor formerly frequently stalled has never reached full-load rating since being equipped with a flywheel. The latter increased its friction load only 50 per cent. Mr. B. G. Beck, Gary, Ind., declared that refinements of control sacrifice vital simplicity. When peaks are large and follow rapidly he expressed doubt as to the operation of complex apparatus. Mr. F. P. Townsend, Ampere, N. J., observed that the questionable advantage between the alternating-current slip-ring motor and the direct-current compound-field motor may, in many instances, be awarded the latter on account of its higher efficiency. Mr. Wilfred Sykes, Pittsburgh, Pa., called attention to the liquid type of regulator extensively applied abroad, using a torque motor to control the depth of electrodes in a soda solution. Mr. E. Friedlander, Braddock, Pa., charged that considerable loss in efficiency results from adding flywheels, citing an instance where manufacturing cost mounted 5 to 15 per cent after equipping a roll motor with a flywheel and slip resistance. Mr. F. D. Egan, on the other hand, declared such regulation a necessity, illustrating by a case where 4000-amp peaks were reduced to 1200 amp. Mr. J. Farrington, Steubenville, Ohio, reported that after endless trouble in a certain mill flywheels were installed, reducing 2000-amp peaks to 1000 amp, while the running current was meanwhile increased barely 20 amp. The power plant, formerly overloaded with one mill, now carries a duplicate mill without additional equipment. Mr. J. H. Wilson, Middletown, Ohio, spoke of the heavy restorative demand taken by one of his flywheel motors after the peak had passed, making it impossible for the Tirrill regulator to hold its voltage. Mr. C. W. Parkhurst, Johnstown, Pa., in discussing the energy consumption of rolls, stated that 1 per cent reduction of 100 lb. of stock had been found to require from 6000 to 30,000 ft.-lb., depending on section and temperature. Mr. B. R. Shover testified that carbon content on chemical analysis has little or no effect on the power taken, actual temperature being the critical element for all materials.

SAFETY.

On Friday morning the electrical engineers held a joint session with the Co-operative Safety Congress. Following several non-electrical papers on general safety subjects, President Shover introduced Mr. C. S. Dowler, Cleveland, Ohio, who outlined the history of hoist and crane limit-switch development, traced from the early open-circuit devices, controller reversers, etc., down to present methods of dynamic braking in which the armature is short-circuited through a resistor, the motor field being meanwhile maintained. Mr. C. W. Richardson reported his own early experiences with limit switches and stop devices, many of which, he said, proved unsatisfactory. He exhibited a two-bar limit switch arranged with short-circuit resistor, carbon contacts and magnetic blow-out. Mr. W. F. Detwiler, Tarentum, Pa., described the use of stationary and movable contacts on the trolley structure to short-circuit the motor armature and open the brake circuit. Mr. James Farrington remarked that the objection raised to getting out full tonnage with limit switches in circuit has been solved by the rule of immediately discharging an employee who blocks his limit switch. Operators are instructed to call inspectors in case their switches open, shutting down the mill for a time if necessary. Mr. B. R. Shover urged that more attention be paid to brake construction.

Mr. R. B. Davenport's paper on dynamic braking described the apparatus and methods of applying retardation by regenerative action used by the Electric Controller & Manufacturing Company. Circuits were reproduced for dynamic braking controllers, methods of readapting drum-type controllers for braking operation, reversing, etc. Dynamic braking relieves the friction brakes of much of their work, since the retardation is chiefly applied electrically. The maximum lowering speed is also limited and operation rendered safer.

SAFETY PRECAUTIONS AROUND ELECTRICAL APPARATUS.

Elaborate precautions are taken by the Inland Steel Company at its Indiana Harbor works, near Chicago, to prevent and minimize accidents to its employees. Statistics show that at least 60 per cent of all accidents are preventable, and the steel company keeps constantly before its employees the maxim that, "while each man is hired to do some particular work, the safety of himself and fellow men is vastly more important than that work." At the entrance to the mills there is a huge sign, 20 ft. high, which reads: "Promote Safety—This is your first duty to yourself and fellow workers." The lesson is accentuated by numerous signs and electric-lighted bulletin boards throughout the plant.

Special attention has been given to the prevention of accidents around electrical machinery. Whenever work is to be done on a motor-driven machine, the inspector or foreman is instructed to hang one of the red boards, "Danger, Do Not Move," on the switch or controller from which the machine is started, writing his own name in chalk

Fig. 1—"The Story of an Accident" on a Bulletin Board.

on the blackboard section below. No one is permitted to remove this warning board except the man who placed it in position.

A photographic series, "The Story of an Accident," has been used with effect in the plant bulletin boards, as shown in Fig. 1. In the first picture the instructor is shown explaining to the inspector the latter's duty, before working on a machine, to hang the warning signboard, with his name, on the controlling switch. Picture No. 2 shows the inspector opening the switch of a motor-driven punch, but from No. 3, where he is seen working on the motor, it is apparent he has neglected to hang up the protective warning sign which still reposes in the pocket of his jacket. In No. 4 the regular operator comes along and, suspecting nothing, closes the starting switch. The result to the unfortunate inspector can be surmised from the fifth and last picture, where he is seen leaving the emergency hospital with his arm in a sling. Such a pictured story has its appeal to even the most unlettered foreigner employed about the works, and supplements the many warning signs which are printed in five languages. The various bulletin boards are lighted by miniature electric lamps for the benefit of the night shifts, and the exhibits contained under these glass covers are changed frequently enough to stimulate interest. The subjects covered include precautions for safety from electrical apparatus, conveying machinery, hot metal, railroad trains, etc.

The principal safety rules of the plant are contained in a succinct statement, designated as the "Ten Commandments" and posted conspicuously about the works. Those referring to general and electrical subjects are the following:

Get the safety habit. Don't take chances. Learn all the rules. Understand your work thoroughly. Study the dangers incident thereto and avoid them. Think before you act.

Never work on a crane, table, or other machinery, until you have notified the operator, and attached a sign, "Danger, Do Not Move," bearing your name, at the point where the power is turned on. No man except the man who placed it should ever remove such sign.

Do not turn on any electricity, gas, steam, air, acid or water, or set in motion any machinery, or throw down any material, without first seeing if anyone is in a position to be injured, and all safety guards are in their proper place.

Do not go onto an overhead-crane runway for any purpose without permission from your foreman, and then not until the cranemen have been notified and a sign, "Danger, Men on Crane Track," hung in cage before cranemen.

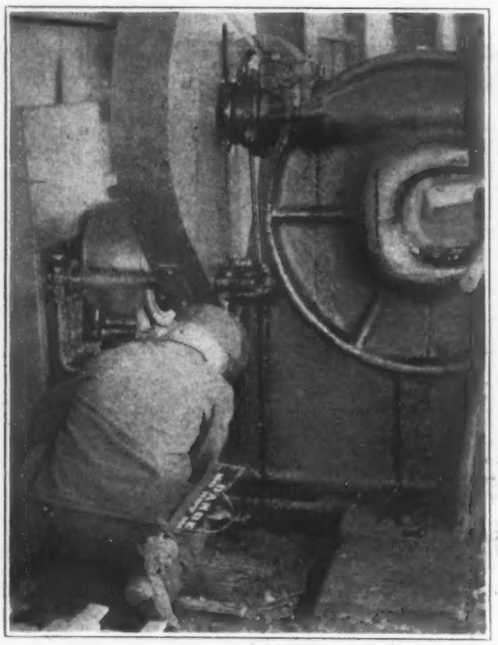


Fig. 2—Wrong Place for Danger Signal.

After notifying cranemen, attach bumping block to crane rail between where you are working and cranes.

PRECAUTIONS AGAINST ELECTRICAL INJURY.

Every employee, while on duty, is required to carry the sixty-four-page book of rules issued by the company. This book must be receipted for, and its thorough understanding by the employee attested to within ten days by his instructor and foreman. Under the heading "Electrical Department" the following rules are included:

Power feeders above 250 volts must be handled with great care, as carelessness may cause a fatal accident. Such systems must never be worked upon when "alive" outdoors during rainy or damp weather, nor otherwise except with approval of chief electrician.

The 250-volt direct-current power circuit under ordinary circumstances is not likely to cause death by shock; but the same precautions should be observed in handling it as those of higher voltage, not only to avoid possible injury from shocks and burns, but to form habits of caution in handling wires. Remember that it is possible to receive a fatal shock from a 125-volt circuit under certain conditions.

So far as possible, treat all circuits as though they were alive, even though you believe them to be dead.

Never handle electric wires while standing or sitting in a wet place without extra precaution to obtain insulation from the ground.

In handling any circuit known to be alive, use only one hand when possible. It is best to keep the other hand behind the back. The most dangerous shocks are those from hand to hand.

When working upon live circuits, care should be taken to work upon only one wire at a time and to insulate properly all parts of the workman from the ground and from other parts of the circuit. Insulate each joint as it is made, before starting on another wire. Be sure you are properly protected from falling from scaffold, crane, etc., in case of shock. Careless haste in working on "live" circuits is the cause of most accidents. Be cautious and alert at all times and under all conditions.

The insulation on electric wires cannot be depended upon to protect you from shock. Avoid working upon any "live" circuits as much as possible.

Never close a switch without full knowledge concerning the circuit and why the switch was opened. (Special emphasis is laid on this rule.)

When a lineman or other electrical worker is engaged at pole work or other overhead work he must wear belt and safety strap.

You are advised to tape the handle of your tools to assist in preventing short-circuits across them.

If you see any electrical equipment in unsafe condition or being improperly operated, correct the conditions or report the matter to the proper foreman.

There are many special conditions which make electrical work dangerous. Even telephone or signal wires may become crossed with high-tension wires, and become dangerously charged. It is not possible to explain in detail all such possible cases, but competent workmen are always afraid.

Never look at an intense arc without adequate protection, such as heavy blue or black glasses. Intense pain results from exposure of the delicate nerves of the eyes to the intense light of the electrical arc. As this pain does not manifest itself until several hours afterward, you should immediately seek the advice of the doctor, if you have so exposed your eyes, to avoid suffering.

When you complete a job never leave tools or material overhead and always replace safeguards.

RULES FOR ELECTRIC CRANEMEN.

For the use of its electric cranemen the Inland company has originated a code of signals to prevent misunderstandings and accidents. Bridge and trolley movements are obtained by pointing the direction of movement desired, other instructions being given by gestures as follows: To hoist, either hand raised straight up. To lower, either arm lowered and moved upward and downward. Easy, either arm lowered and hand moved upward and downward. Stop, either arm lowered and moved back and forth in front of the body.

Where approved by department superintendent, the following whistle signals are used: Bridge to signalman's right, one short blast; to left, two short blasts. Trolley racked in toward cage, three short blasts; out from cage, four short blasts. Hoist, four long blasts. Lower, three long blasts. Easy, two long blasts. Stop, one long blast.

In general, employees working around machinery are cautioned about using gloves or wearing unsuitable clothing, such as ragged sleeves, loose coats, ties or jumpers, since these are extremely liable to be caught in the machinery. Warning is also given against wearing celluloid eye shields, cap fronts, collars, etc., since this material is highly inflammable and may cause serious injury. To make sure that these safety regulations are carried out, the Inland Steel Company maintains a department of inspection, which is in charge of Mr. J. C. Smith.

Central Station
Management, Policies and Commercial Methods

MINNEAPOLIS COMPANY TO OPERATE MUNICIPAL PLANT.

During the month of September the Minneapolis General Electric Company broke all previous records in gaining new customers, placing 919 meters. A contract of particular interest has been closed with the city of Shakopee, Minn., to operate the municipal plant in that city with energy supplied from the Minneapolis central-station system. Negotiations with the municipal authorities of Shakopee have been pending for some time. The city operates a small municipal plant, but finds that it can buy energy from the Minneapolis company cheaper than it can make it. A contract was also closed with the Shakopee Stove Works, heretofore a customer of the municipal plant, for 250 hp.

CONSIDERING THE WOMAN'S POINT OF VIEW IN A HOUSE-WIRING CAMPAIGN.

It is frequently not the cost of electric-light service itself that deters the householder from having his house wired. Analyzing the matter from a psychological standpoint, the refusal or putting off will many times be found in the average woman's horror of a "mess" such as she believes is the inevitable concomitant of wiring an old house. This state of mind should be recognized by the new-business manager of the central station, and in educational work along the line of house wiring the initial argument presented to the fastidious homemaker ought to dwell upon the ease with which such wiring can be done. Stress should be laid upon the fact that it does not necessarily involve open walls, torn-up floors all through the house, disfigured wainscoting and torn wallpaper that cannot be properly matched afterward.

In a twenty-four-page pamphlet, 3⅜ in. by 6¼ in., issued by the St. Clair Gas & Electric Company, Belleville, Ill., and entitled "Information for Electric Consumers," the opening chapter is devoted to the wiring of the home, explaining, in a way which cannot fail to make a direct appeal to the feminine element of the household, how neatly such work can be done. Other chapters of general interest to consumers, present and prospective, and two pages giving the conditions of the contract entered into after the wiring is installed, contribute to a useful little publication.

MOTOR DRIVE IN A CIDER MILL.

By R. B. Mateer.

A typical instance of the use of motor drives in a cider and vinegar mill, briefly described, may be of service to central-station men in localities where apple growing is an extensive industry.

In the plant in question apples are unloaded by the carload upon a conveyor which elevates them to the second floor of the establishment, and there they are fed to a 12-in. Boomer & Boschert grater operating at 2200 r.p.m. This grater is driven by a 440-volt, 60-cycle, three-phase, 20-hp motor and handles an average of two carloads, of 80,000 lb., of apples during each day of ten hours. The crushed fruit is then conveyed to a press where it is subjected to a pressure of 120 tons for the purpose of extracting the juice. The press is operated by a 440-volt, three-phase, 10-hp motor.

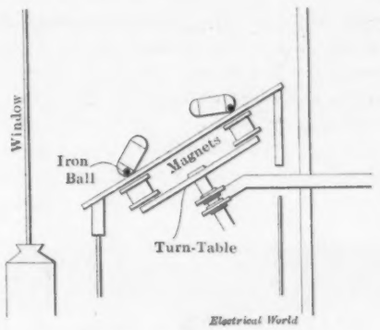
After the first pressing the pulp is preserved for a time and allowed to ferment, after which it is re-pressed and produces a yield of liquor equal to about 25 per cent of the first run. Two power pumps, each with a capacity of 40 gal. per minute and driven by a 5-hp motor, raise the liquor to a roof tank. Thence it is fed to a series of troughs placed over huge generators and permitted to drip over birch shavings placed within the generators, where acetic acid is produced by oxidation.

The product, pure apple-cider vinegar, is finally conveyed to three 35,000-gal. tanks and then barreled or bottled for delivery to the wholesale or retail dealer respectively. The maximum capacity is three cars, or 120,000 lb., of apples per day. It is said that Western apples produce from forty to sixty barrels of liquor per carload during the first pressing. The entire motor installation consists of one 20-hp, one 10-hp and two 5-hp motors, or a total of 40 hp. No steam is required in the process at any point.

ELECTRIC WINDOW-DISPLAY DEVICES.

To give point to the printed statement near by that his phonograph records are "entertaining," a St. Louis dealer in talking machines has a window exhibit with two round-ended cylindrical record boxes which follow each other with a succession of somersaults around the inclined table top. This odd effect is accomplished by rotating a pair of magnets inside the table beneath the path of the capsule-shaped tumblers, each of which contains a small iron ball. As the balls are drawn around under the attraction of the magnets the capsules advance with a peculiar somersaulting action that arouses the curiosity of every passer-by.

Another curiosity-provoking stunt seen in a local drug-store window is a "perpetual-motion" machine made up of four widely advertised razors stuck into a large cork, the whole rotating on a nail point which bears on an inverted glass tumbler. Loiterers in front of the window offer many wise explanations of concealed magnets, commutating devices, etc., but the secret of the continued motion is an 8-in. electric fan hidden among some boxes at the rear of the window.



Window-Display Device.

An electrical contractor at Billings, Mont., has varied the usual arrangement of the "wireless" incandescent lamp burning on a pane of heavy glass without visible electrical connection by suspending the glass on strings between two portable fixtures. Although casually set in the window, these fixtures make contact with live studs, and the white string is treated with a coating which conducts the fraction of an ampere necessary to energize the 25-watt lamp. This lamp is mounted at the center of the top edge of the glass plate, and the strings are tied into holes near the corners, a strip of tinfoil being pasted along the edge of the plate and covered with green paint to simulate the ordinary appearance of the thick glass.

MOTOR SERVICE IN ARTIFICIAL-ICE PLANT.

The Mutual Manufactured Ice Company, with a factory at Kedzie Avenue and Fillmore Street, Chicago, has contracted with the Commonwealth Edison Company to take electrical energy to operate about 400 hp in alternating-current motors to drive all the machinery in its artificial-ice plant. The central-station engines report that the Mutual company has been using directly coupled oil engines to drive two compressors, but that the engines in use proved unsatisfactory for the service desired. They are to be discarded in favor of electric motors and central-station service. The plant is designed to produce 100 tons of ice daily.

"FASHION WEEK" IN OKLAHOMA CITY.

During the State Fair recently held in Oklahoma City, the Retailers' Association instituted what it termed "Fashion Week" and offered substantial prizes for the best decorated

Fig. 1—Winner of Prize for Best Illumination.

windows. In judging, illumination counted for a large number of score points. In addition to the association prize the Oklahoma Gas & Electric Company offered a prize of $50 cash to the exhibitor of the best illuminated windows. The prize was won by the Kerr Dry Goods Company, whose exhibit consisted of three richly clad figures standing on a floor of light satin and before a white and gold background. It occupied a space of 6 ft. by 13 ft. and was illuminated by

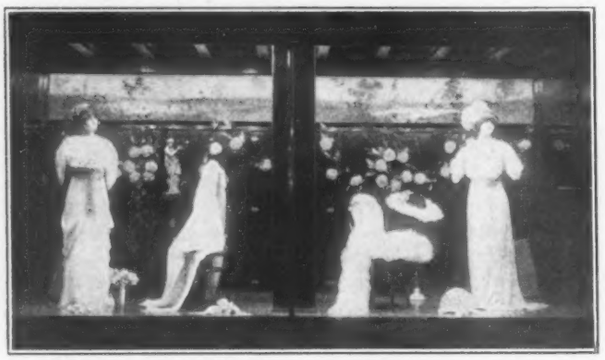


Fig. 2—Prize Winner in Fashion-Week Contest.

sixteen 40-watt lamps placed by pairs in "poke bonnet" reflectors located near the front edge of the window so as to be entirely concealed from the spectator. Every detail of the window was plain.

About 150 merchants took part in the contest and it was declared such a success by all concerned that "Fashion Week" will be made an annual event. Naturally the Oklahoma Gas & Electric Company was well pleased with the results, for anything that will turn the attention of 150 merchants to the illumination of their windows and stores is well worth while.

STORE ROOM, GARAGE AND STABLE METHODS AT MILWAUKEE.

In the equipment of the new Cold Spring store rooms, garage and stables of The Milwaukee Electric Railway & Light Company unusual care has been exercised to insure efficiency.

The combined garage and stable has accommodations for two 3-ton, two 2-ton, two 1500-lb., four 1000-lb. and two 750-lb. electric trucks and wagons, besides several gasoline runabouts and twenty-eight horses. Energy for charging batteries is supplied to the sixteen wall plugs through a Cutler-Hammer panelboard by a 35-hp, 60-cycle motor belted to a 220-volt generator and by two General Electric rectifier sets. Near by is the shop where general repairs are made. For the comfort of the men who have to work on their backs beneath machines a light wood framework, 4 ft. by 3 ft., with cushioned head rest, is mounted on four casters. At each side of the body are channels for holding tools, etc. Lying flat on one of these, the workman can move about with ease beneath a car body, without rubbing his clothes in oil and dirt. Similarly roller-shod boxes for tool allotments are to be issued to individual workmen, each man being held responsible for his own tools.

The general supplies for the wire department are classified and stored on the floor beneath the garage and stable. The latter connects with the street level, while the store room below is provided with two spur tracks from the shop transfer table. Directly opposite the elevated, and most accessible, are the automobile repair parts. Next in order come the line-material supplies, bolts, washers, steps, brackets, wire, etc.; next, the trolley department's supplies, installation department's supplies and underground department supplies. The last-named is at the end of the store-room and alongside the cable yard. Small parts, hardware, etc., are stored in Durand steel bins having eight shelves adjustable at 3-in. intervals. The entire stable and store building is equally fireproof, being constructed with a steel frame, brick walls, tile partitions, concrete ceilings and cedar-block flooring in the wagon room. Self-closing steel doors are installed throughout. All posts carrying fire extinguishers, buckets, hose, etc., are painted with a broad red band.

The stable staff comprises one general stable foreman, who is on duty nights when the important work is to be done; his assistant, who takes his place during daylight hours; one blacksmith (night duty), an automobile mechanic and helper, three barn men and two store-room keepers. All wagons are stocked up and orders filled at night, so that everything is ready for an early start when the crew arrives in the morning. Hand-drawn trucks are used to assemble the orders in the ground-floor store room, each truck being given a number corresponding to a wagon. When the order is complete the hand-truck is wheeled to the elevator and raised to the wagon level. Stock returned from wagons to be credited is meanwhile unloaded onto another truck and run to one side until the attendants have time to check off the items. The truck system thus simplifies loading and avoids holding up a wagon while orders are being charged or credited. Transformers, motors and other heavy apparatus can be unloaded directly onto the elevator from either track which is not in use, raised to the second-story level, lifted off by means of the Harrington trolley hoist and, still suspended, pushed along the monorail spur to be loaded on to wagons or transferred to the transformer room for storage. The stairway connecting the two floors is entirely inclosed in a brick well, as a pre-

caution against spreading of fire. At the landing level, however, is a 12-in. by 24-in. glass window commanding a view of the whole store room, while near by is a special switch enabling the night watchman to light certain lamps in the room below, so that the room and its contents may be inspected without the necessity of actually entering.

Among the noteworthy conveniences provided for the

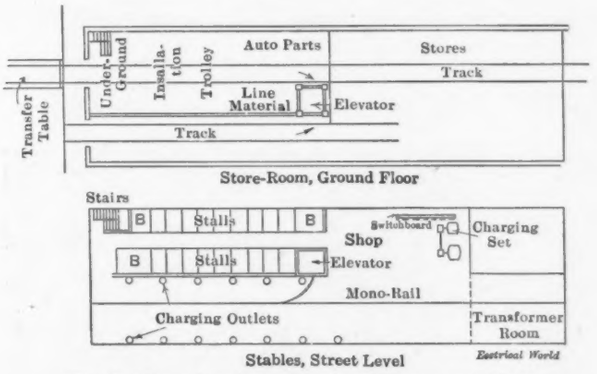


Fig. 1—Plan of Cold Spring Store Rooms and Stable.

horses should be mentioned the drinking-water system. Each horse is assured an ample supply of fresh water at all times by a float-controlled valve which admits water to the common level of the various drinking basins. This level is restored as fast as the horses drink up the contents of their troughs. From the rear of each manger is hinged a wicket of light iron bars. While being filled this is lifted up and the hay placed underneath, so that the animals are required to eat the hay from between the bars of the grill, which follows down with a diminishing pile. With this grill in place the horses cannot "nose" the hay or scatter it, to be trampled under foot and wasted. All receptacles for oats, salt, etc., are removable and can be thoroughly cleaned.

An interesting system has been developed for handling storeroom orders and supplies at the new Cold Spring stables. This store room is assigned to the wiring department, which is composed of the railway, electric-lighting and power, underground, trouble, telephone and installation divisions. There is thus combined under one head the stable, horse-drawn vehicles, electric trucks, gasoline trucks and trouble cars, stores and supplies and the pole storage yard. The poles are shaved, framed and painted in the yard before being delivered on the work.

With this combination of the different divisions under one central head for stores and supplies it will be evident that the "load factor" can be increased materially. At the same time the head of the department responsible for the work is in closer touch with the materials on hand and is enabled thereby to carry on more efficient work.

The scheme of securing supplies from the store room and keeping record of them is as follows:

All jobs put in are estimated before work is installed by the "line-slip inspector." The gang foreman calls the office by telephone at 4:30 p. m. daily to receive his orders and

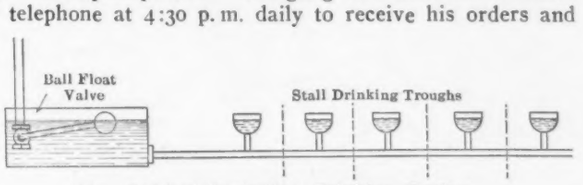


Fig. 2—Float-Controlled Drinking Basins.

instructions for the following day. At this time the general foreman of the department gives the gang boss his instructions over the telephone, reading from the estimate the material the foreman will require the following day. The gang foreman then makes out a duplicate requisition on a form previously prepared. These are taken to the store room by the driver, who turns them over to the store-keeper.

During the night the store-keeper gets out all new items of material as requested by this requisition, entering these on the original and on the duplicate, all other material having previously been removed from the wagon to be checked. The duplicate goes to the gang foreman, who immediately reweighs his wire and checks his items of material, noting any discrepancy. He then proceeds with the various job orders for the day, carefully marking down on his report the items of material used on each job, as well as the names of the men and the hours which they worked on each job, time of starting and completion, etc. These reports are collected by the general foreman, together with the requisition copies, and a separate wire report of wire, solder and tape received.

The general foreman then countersigns the report, certifying that it is correct, etc. These reports and requisition copies are next turned over to the material clerk, who is directly under the superintendent of wire and is not responsible to any other department or division. This clerk immediately estimates the various reports, checking the footings of all reports of each gang against the requisition and the material returned. If the items of material balance and the charges are correct he then returns to the general foreman of the department requisitions made out for each job number for the general foreman of the department to countersign.

These requisitions are then sent to the store-keeper, who in turn checks the material with an inspector of the accounting department, charging off material on the bin cards. After this the requisitions are certified to and sent to the general stores department, which makes the necessary entries on the general stock cards. Thence they go to the accounting department for its disposal.

Under this plan it can be readily seen that each transaction checks the other and that it forces the men to make out reports carefully, in order to secure payment for their time. This in turn benefits the record department, since the reports are turned in with correct data.

CAMERA FOR CENTRAL-STATION USE.

A new and useful adjunct to the equipment of a Middle West central-station office is a graflex camera which is kept loaded with plates at all times, ready to be used for photographing accidents or other incidents of which a pictorial record is desirable. All the men of the office have been instructed in the method of using the camera, which has a large lens and can take snapshots in the shade. When an accident is reported, the camera is dispatched to the scene, and pictures are taken of the lines, poles, insulators and any other objects which could have a future bearing in any inquiry that might develop. The record obtained in this way is valuable testimony in case of possible suit and also affords a complete report of the entire accident for the avoidance of future trouble.

FREE REPAIRS TO ELECTRIC FLATIRONS.

The Montrose Electric Light & Power Company, Montrose, Col., which is controlled by the Federal Light & Traction Company, has carried on an aggressive campaign for the introduction of electric flatirons, as a result of which there are now 425 irons in use in a city having a population of 3500, or practically one iron for every eight inhabitants. In order to encourage this business the company has adopted the plan of making free repairs to electric irons purchased at its supply store. The company finds that this is a fruitful expedient to keep electric irons in use and tends to prevent their abandonment when defective in favor of some other type of iron.

Wiring and Illumination

CURB LIGHTING POSTS WITH "HANGING GARDENS."

Minneapolis' downtown streets have been rendered attractive during daylight hours with the greenery of flower baskets which grace a number of the curb-lighting posts. This ornamentation of the tungsten standards is the sequence of a general movement encouraged by the Minneapolis Civic and Commerce Association to decorate the business section with "hanging gardens," window boxes, flower baskets, etc. A special container is arranged to fit over the top of the five-lamp standards, and in this flowers, ferns and trailing vines are planted, producing the charming effect seen in the illustration. The cost of equipping such a post the first year is about $6 and for succeeding years $4.50. This outlay has in each case been defrayed by the abutting property owner or tenant. In the Minneapolis instance these bits of green which fleck the downtown streets have given to the city the appropriate title "the City of Hanging Gardens" and have done much to remove the false impression created by the old annual ice palace that Minneapolis is in the Arctic instead of the "banana" zone.

Minneapolis Curb Post with Flower Basket.

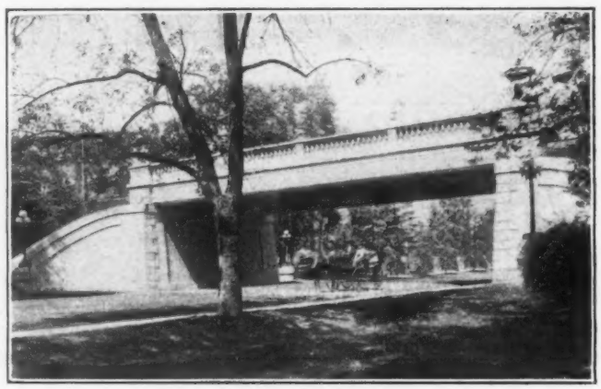
TESTS AND DEFLECTIONS OF CONCRETE POLES.

A paper by Mr. R. A. Cummings, read before the Association of Iron and Steel Electrical Engineers at Milwaukee, Oct. 4, described methods of forming concrete poles and reported tests and deflections of the finished structures. The author recommended a mixture of one part of Portland cement to six parts of coarse and fine aggregate, but for casting the poles in a horizontal position advised against too liquid a mixture, the constituents of which, he warned, may tend to separate out, reducing the strength of the pole. Within twenty-eight days poles should be able to withstand a test load of 2000 lb. For wind-pressure calculations an assumption of 100 lb. per square foot, equivalent to a 100-mile gale, is usually ample. He reported some tests performed by the New York Central Railroad, using a locomotive and dynamometer car through a four-to-one pulley reduction, in which two 24-ft. poles designed to withstand 2000 lb. with a safety-factor of four were tested to destruction. The first pole withstood a maximum of 7810 lb. and was deflected 2 ft. 1 in., while the second carried 8125 lb. and was deflected 2 ft. 2.5 in. Comparing the cost of chestnut and concrete poles on a basis of twenty-five years' service, including labor of renewing, etc., assuming chestnut to have a life of twelve and a half years, the author gave the values in the accompanying table for various heights:

	25 ft.	30 ft.	35 ft.	40 ft.
Chestnut poles	$60.45	$71.35	$84.81	$101.51
Concrete poles	35.50	45.25	62.50	84.25
Saving effected in per cent.	40	37	26	17

ORNAMENTAL LIGHTING OF A PARK BRIDGE.

The accompanying illustration shows the ornamental treatment accorded a steel deck-girder bridge on which a railroad crosses one of the drives of Forest Park, St. Louis, the former site of the Louisiana Purchase Exposition. Ornamental tungsten fixtures, similar to those recently installed about the new City Courts and City Hall buildings downtown, have been used to mark the approaches to this concrete structure, each post carrying four 40-watt lamps and one 60-watt lamp inclosed in milk globes. The standards measure 8 ft. in height and are mounted on concrete pedestals which raise their bases 4 ft. above the ground.



Ornamental Lighting of a St. Louis Park Bridge.

INDIRECT ILLUMINATION OF A DRAFTING ROOM.

The drafting room of the Nordberg Manufacturing Company, Milwaukee, is illuminated by forty-five indirect units of severely utilitarian design, each containing a 250-watt tungsten lamp, and produces an average intensity of about 10 foot-candles at the level of the table tops. The installation was designed for maximum diffusion and high illumination and is largely experimental in this respect, as the capacity of the units is adjustable. Although wholly satisfactory at present, the intensity can later be varied if desired. The simple fixtures shown were developed to meet a need for inexpensive holders for the silvered glass reflectors, and were cut out and soldered up in the tin shop. Since this initial Nordberg installation similar equipment has been used in several other Milwaukee drafting rooms.

The Nordberg room measures 65 ft. x 75 ft. From one corner of it an area 22 ft. x 30 ft. is partitioned off for locker rooms and stairway. The main room, 4215 sq. ft., is lighted by forty-five reflector units, each containing a 250-watt lamp. With this net use of 2.7 watts per square foot, an average intensity of 10 foot-candles has been measured, as already explained. The bowls are truncated cones of heavy galvanized iron painted inside and out, with bases 14 in. and 5 in. in diameter. The bowls measure 9½ in. in perpendicular height. Each unit is suspended by three chains, with its upper lip 30 in. from the 12-ft. ceiling. A skeleton framework inside the bowl supports the mirror reflector inclosing the 250-watt lamp. The Nordberg private plant is a 220-volt direct-current installation and the lamps used are 110-volt units, the fixtures being wired two in

series. Control is centered in a panelboard which contains a switch for each pair of fixtures, so that in the event of a few draftsmen working overtime only the corresponding part of the installation need be turned on. Numbers painted on the bottoms of the bowls correspond to the switches in the cabinet, enabling any desired group of lamps to be lighted without experimental switching. The reflectors in this installation are cleaned once a week. Cleaning is facilitated by terminating one of the chains in a hook which is readily removable, dropping open the bowl. The lamp socket is attached by enough slack cord to enable reflectors and all to be lifted clear for a thorough cleaning. A light cream kalsomine has been used to tint the ceiling, a darker shade being employed on the side walls and a still darker color below the chair rail line. The draftsmen here use the dull side of the tracing cloth, and experiments are in progress to secure improved tints of drafting paper, etc. In laying out the installation, the fixtures have been so placed that the predominating direction of natural light from the windows is largely duplicated. Especially will it be noticed that the units are not merely located at convenient symmetrical divisions of the ceiling panels, as is often done in laying out similar installations. Instead, the reflectors are well distributed at approximately 7-ft. intervals in rows approximately 10 ft. apart. Conduit and condulet outlets have been used throughout. The men who work under this illumination seem well pleased with its quality and intensity. Fig. 2 shows a late modification of the same utilitarian fixture used in another local drafting room. Hollow brass tubes replace the chains, one wire being brought down each of two tubes. Hooks and surplus cord facilitate cleaning as in the Nordberg type. The canopy shown is non-essential to the design and is sometimes omitted to advantage, the fixture being hung directly on a fixture-insulating joint attached directly to the outlet box. Messrs. Vaughn & Meyer, Milwaukee, were the consulting engineers for the Nordberg and other installations and developed the special fixtures used.

Fig. 1—Indirect Illumination of a Milwaukee Drafting Room.

Fig. 2—Simple Indirect Fixture Developed for Drafting-Room Lighting.

ILLUMINATION AT THE ELECTRIC RAILWAY EXHIBITION IN CHICAGO.

The accompanying picture gives a general view of the central Arena at the International Amphitheater, Chicago, during the exhibition of the American Electric Railway Manufacturers' Association on October 7-11. It is of interest in showing the general arrangement and decorations of a portion of this fine collection of exhibits and also in illustrating the method of lighting and the decorative illumination in the central hall. The picture was taken from the gallery near the main entrance on South Halsted Street. In the foreground is shown the indoor lawn at the entrance consisting of grass plots, flowers and plants and concrete walks. The 200 exhibits were shown in three halls—the Arena, which is illustrated; Machinery Hall to the south and the track exhibit on the north. These were connected by the Straightaway, also lined with exhibits, and there was a large outdoor car exhibit. The galleries in the Arena were devoted to exhibits, which were also to be found in about every other available space under galleries and in corridors. Mr. H. G. McConnaughy, of New York, secretary of the Manufacturers' Association, said that a greater amount of space could have been sold if available. Nearly all kinds of machinery and appliances used in electric-railway operation were exhibited.

View of the Electric Railway Exhibition, Showing Illumination.

For the main lighting of the Arena were provided large "bowls" or "sunbursts" suspended from the ceiling. There were fifteen of these in the Arena, each studded with 160 60-watt tungsten lamps. These 2400 overhead lamps pro-

vided brilliant illumination. In the other halls the same scheme was followed out, but the bowls were smaller. The most interesting feature of the illumination of the Arena was the fifty lighting columns, many of which are shown prominently in the picture. These were 9 ft. high, of a modified Corinthian order, the fluted columns being 10 in. in diameter. The capital was surmounted by a globe 16 in. in diameter. The columns were of a new white translucent glass known as Moonstone glass, and, like the globe, were lighted from within, the softly glowing shafts of white being very pleasing. Each column was supported by a vertical interior pipe which also was provided with brackets and sockets for twenty-six 16-cp carbon lamps, half burning tip upward and half tip downward. The surmounting ball contained a 40-watt tungsten lamp. The columns were designed for the exhibition, and it is said that this was the first installation of interior-lighted glass columns of so large a size. Electricity was obtained from the large private plant of the Union Stock Yard & Transit Company.

CONDUIT VERSUS OPEN WORK IN PLACES SUBJECT TO MOISTURE, CORROSIVE FUMES, STEAM, ETC.—II.

By F. G. Waldenfels.

In the previous article general packing house conditions were described and the need of first-class work even under most favorable circumstances emphasized. Older forms of open-work wiring were discussed and in the present article later forms of open work are taken up in detail.

SPLIT KNOBS.

In the past two years the No. 4½ split knob has become very prominent; in fact, it has completely replaced the solid knob in the Chicago territory. It has advantages over the solid knob in that it does away with knots and eliminates a great deal of the twisting of wires around knobs, thus prolonging the life of the insulation. Besides, there is a saving in labor because with split knobs it is only necessary to fasten the two ends and then fill in the intervening space with a knob every 4½ ft. With the solid knob it is necessary to give the wire a turn around each knob, but with the split knob the wire goes straight through the knob. Different sets of grooves are provided for sizes of wires from No. 14 to No. 8.

Should a line support become broken or knocked loose, the line wire remains taut, another advantage possessed by the split knob over the solid knob. On the ends of the line

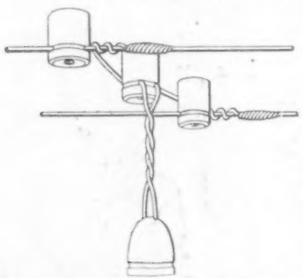


Fig. 3—Method of Using Split Knobs for Supporting Line Wires and Drops.

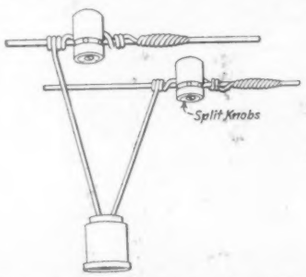


Fig. 4—Method of Anchoring Drops from Line Supports.

some electricians prefer to use two solid knobs and wrap the wires around them figure-eight fashion, ending with a few turns around the line wire. An expert electrician, however, can make just as good a job with split knobs. The No. 14 stranded wire drops are also anchored from a No. 4½ split knob, doing away with the knobs that formerly had to be used in the case of a solid knob installation. Fig. 3 illustrates a most satisfactory installation of knob work.

Fig. 4 shows another method of employing split knobs for line supports and at the same time anchoring the drop from the line wires. This is a very good scheme, as it enables one to do away with the anchor knob. The drop is anchored by giving the drop wire a few turns in front of the knob and a few turns in back of the knob before making the joint. There is, however, one objection to this scheme

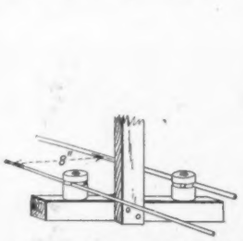


Fig. 5—Inverted "Tee" Method of Supporting Wires with Split Knobs.

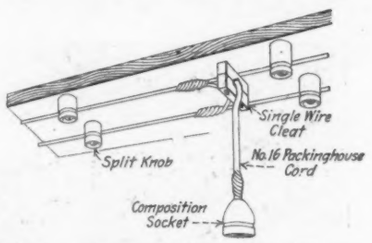


Fig. 6—Method Used for Installing Split Knobs on Running Boards.

in that when an extension is attached to the socket all the strain comes on one wire.

INVERTED "TEE."

Several packing plants employ the inverted "tee" method of wiring, which is second to the pin and insulator for good insulating qualities. In this method use is generally made of the No. 4½ split knobs for the line supports. The wood used is dressed 2-in. x 4-in. lumber painted with asphaltum. The knobs, it will be observed from Fig. 5, are turned upward so that the water cannot constantly run down them. Weatherproof sockets are anchored from split knobs on the line supports in the usual manner. This scheme of wiring is more expensive than the ordinary open work.

KNOBS ON RUNNING BOARDS.

In places not subject to excessive moisture split knobs or separable knobs on running boards make a very good installation. When passing under beams or other obstructions circular loom is employed between the supports. If switch legs are necessary, they may be run down the wall or column in conduit, and snap switches should be mounted in a condulet.

The running boards are made of dressed lumber, 1 in. x 6 in., and painted with asphaltum or mineral paint. They afford protection from mechanical injury. If packing house cord is used for the drops, it is anchored with a pair of single wire cleats, but if stranded No. 14 wire is used it is preferable to employ No. 4½ split knobs as the anchoring medium. This kind of construction costs about as much

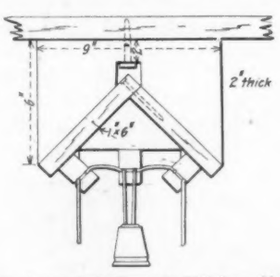


Fig. 7—Inverted-Trough Wiring, Using Split Knobs.

as conduit, and, that being the case, galvanized conduit would give far better results if properly installed.

TROUGH WIRING.

In excessively wet places and hide cellars inverted wooden troughs (Fig. 7) have been installed with good results. In order to obtain a good job a carpenter should install the troughing, especially where obstructions are encountered, and an expert electrician should do the wiring. Especial pains must be taken to get a tight waterproof joint.

The trough affords protection from mechanical injury and keeps water from dropping on the wires. Supporting blocks are placed every 4½ ft. and the troughing is screwed to them. All the lumber should be dressed and painted. The supporting blocks should be 2 in. thick by 9 in. wide and the boards 1 in. thick by 6 in. wide. In some cases the

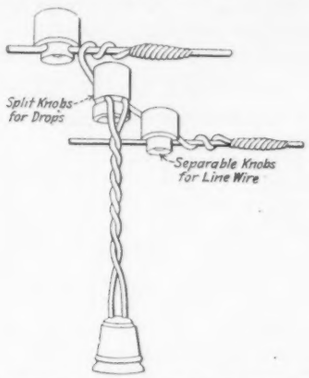


Fig. 8—Method of Supporting Line Wire with Separable Knobs.

trough alone costs 6 cents a linear foot. When to this is added the cost of the labor of carpenter and electrician it will be evident that the method is very expensive and costs much more than a good conduit installation. A small V-shaped block is screwed to the under side of the trough to hold the anchor knobs. No. 4½ knobs have given the best satisfaction for line supports and drop anchors. The disadvantages of this system are that the wood rots rapidly and the initial expense is great. In one case of which the writer has knowledge the open wiring in the trough had to be replaced about every six months. Finally the chief electrician became tired of the constant rewiring necessary, and two years ago he replaced the open wiring with galvanized conduit and cast-iron condulets. No trouble has emanated from the conduit installation yet, and it looks as if it would last a few more years, although the conduit is in a very wet place and over offal tanks. In the opinion of the writer, trough wiring is a thing of the past and can very easily be replaced with better results by properly installing the right kind of conduit.

GUARD STRIPS.

On low ceilings where wires are subject to mechanical injury guard strips have served very well in many places. These strips are 1½ in x 1½ in. square and are placed about 1½ in. from the outside of each wire.

SEPARABLE KNOBS.

The separable-knob construction (Fig. 8) makes an ex-

Fig. 9—Method of Supporting Line Wires and Drops with Separable Knobs.

cellent job. The line wires are fastened at the ends to a pair of solid knobs (figure-eight fashion); then separable knobs are inserted every 4½ ft. When the cap of this knob is screwed up tight it takes up slack in the wire, an advantage possessed by this type of knob over other types; but the knob, on the other hand, is more fragile than a split knob. All sizes of wires from No. 14 to No. 8 B. & S. gage can be used with this knob, and the drop is generally anchored from a No. 4½ split knob, as previously described.

Fig. 9 illustrates another method of installing separable knobs, where they are shown used as supports for line wires and at the same time for drops. This makes a serviceable installation of very low cost.

SOLID PORCELAIN SUPPORT.

A support that has been used almost exclusively in one plant for open work in wet and steamy places, and which the electrician claims has given satisfaction in the four years that it has been in service, is made of solid porcelain so thick that the breakage is negligible. It costs about four times as much as a split knob and a general installation costs nearly as much as a conduit job. The support is easily installed with a ⅜-in. x 5½-in. lag screw. The insulator carries the two line wires and a place is also reserved for the drop, which can be anchored from the line supports or from the individual part of the support reserved for it. As far as supporting the wires is concerned, an installation of this kind does not differ much from the old solid knobs which require a twist of the wire around each knob. But the small screws have been eliminated and replaced with one large one, and instead of two or three knobs they are all molded into one. The lag screws are dipped in compound before being used, and are thereby protected from corrosion.

IRON BRACKETS FOR GLASS INSULATORS.

The original wiring of one packing house was installed with iron brackets and glass insulators screwed to a wooden pin, but this proved very unsatisfactory. In places subject to moisture and corrosive fumes the metal arms practically

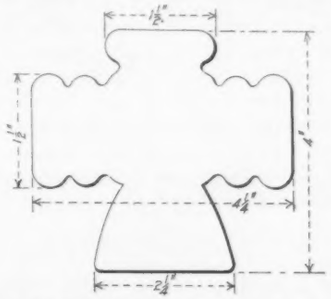


Fig. 10—Single Solid Porcelain Support for Both Line Wires and Drop.

vanished, allowing the lines to fall; the wooden pins swelled and cracked the glass insulators; the iron screws holding the brackets to the woodwork also corroded until the heads fell off, allowing the brackets to hang in any way. As fast as the circuits in this installation break down they are being replaced with circuits wired on supports, or solid porcelain No. 4½ split knobs, and lately a great deal of the best conduit has been installed in the very worst places with good results.

JOINTS.

The joints should be given particular attention in any installation; but unfortunately they are very often poorly soldered and loosely taped, so that moisture attacks the copper and corrodes it until it becomes so small that it either heats up, starting a fire, or breaks off. The writer has seen joints that were fairly well compounded but loosely taped. The water consequently leaked in and, surprising to say, everything in the compounded tarry shell was turned into a green plastic paste, which had eaten the wire entirely away.

Joints should be made as follows: When cutting the insulation the knife should be drawn slantingly toward the wire, not straight, or otherwise the wire will be nicked. The joint should at first be so spliced as to be both mechanically and electrically secure. Fig. 11 shows how a common splice should be made, Fig. 12 the way to make a tap to a line wire, and Fig. 13 one way to tap for heavy wires. These joints are standard and are approved by all underwriters. All the wires for the joints should be scraped perfectly clean and free from insulation. In Fig. 11 the two ends are given several complete long turns, then the ends

are given four complete short wraps. In Fig. 12 the wire is given two long turns for play room, then four short turns. In Fig. 13 the wires are bound together with a layer of No. 12 or No. 10 bare copper wire closely wrapped. In all cases the joints should be cleaned with a standard soldering flux (not one that will form a battery couple and eat out the joint) and soldered with pure half-and-half solder.

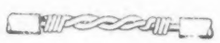


Fig. 11—Common Splice.

Fig. 12—Tapping a Line Wire.

For wet and steamy places the bare joint after being soldered should be thoroughly covered with insulating compound, which acts as a direct protection from moisture should water leak through the tape. Then rubber tape should cover the whole joint, followed by several tight layers of friction tape. Then for a good, permanent job the whole joint should be waterproofed by completely covering it with an application of compound or insulating paint.

TIE WIRES.

There are certain ways to fasten tie wires properly to hold line wires to insulators or knobs. Fig. 14 shows top and side views of an insulator to which the line is attached by the well-known single tie, made by bending a piece of wire about 12 in. long around the insulator and under the line wire with three or four turns on each side, the ends being cut off close. Fig. 15 shows a back tie. A piece of wire about 18 in. long is bent around the insulator under the line wire with 4 in. of tie on one side and the remainder on the other. The short end is then wrapped three times around the long wire, leaving a space equal to the diameter of the wire between each of the wraps. The long end is wound closely around the line wire two times, brought back around the insulator and wrapped three times around the line wire between the turns of the short end.

WIRES.

The kind of wire used for open work is a very important feature of the installation. The rubber insulation must, to stand the severe conditions of moisture, salty atmosphere and corrosive fumes, be of very good quality; in fact, it should be extra special. Ordinary single-braided wire with 3/64-in. rubber insulation would soon break down, but wire with 3/32-in. rubber insulation having in it about 30 per cent para and being triple braided, gives very good results if the wiring is not subjected to mechanical injury. The cost of this special wire, however, is about $50 per 1000 ft., several times that of ordinary No. 14 rubber-covered wire, but the results obtained more than compensate for the higher cost. With this heavy insulation No. 12 wire is generally used for branches. If conduit were installed, the ordinary rubber-covered, double-braided duplex No. 14 New Code wire would give as good results, and the wires would always be in a safe place.

WIRES FOR DROPS.

Best results have been obtained by using a pair of stranded No. 14 rubber-covered, single-braided wires for

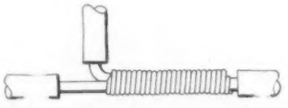


Fig. 13—Tap for Large Wires.

drop lamps. Ordinary commercial cord will not answer, and No. 16 rubber-covered, single-braided solid fixture wires (twisted pair) have been used most extensively in one plant in connection with taped and painted brass T. & H. base-key sockets, with satisfaction. For long drops packing-house cord is very good, but it should be anchored with a pair of single wire cleats, otherwise it is difficult to provide a good support. Packing-house cord, however, is not extensively used.

Experiments are now being made with a new drop cord said to be flameproof. It is made of No. 14 rubber-covered stranded wire having a slow-burning braid on the outside. Observations made at an installation indicate that it may give very good results. If a short-circuit occurs it has been demonstrated that the cord will not carry the flame; whereas with ordinary types of drop cord the flames from a short circuit feed on the insulation and set fire to the ceiling.

LEAD-COVERED WIRES.

There are many installations employing lead-covered wires supported on knobs and others where the lead-covered wires are inclosed in conduit. Each wire has a rubber insulation over which is a lead sheath. The lead affords a good protection from salty atmosphere, acids and moisture. When supported on knobs, for fear of grounds collecting on the lead sheath which would make it alive, short strips of the lead are carefully cut from the wire, the spaces being taped and painted or compounded to keep the moisture from entering between the lead and the rubber. In some fertilizer rooms open work with lead-covered wire on knobs has not given the satisfaction expected. The wires were disturbed and broken by mechanical injury, making the installation very hard to repair; but on the other hand the lead affords a very good protection to the insulation from the peculiar acid and moisture found in such places. Where taps to the lead-covered wires are made for the drops the joints should be carefully compounded, taped with rubber and friction tape and then compounded again. It is essential in such work that every bit of the surface of the finished joints be covered with compound, because if there is a slight

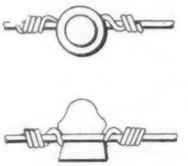


Fig. 14—Single-Tie Method.

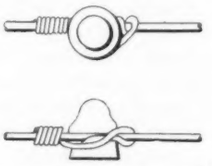


Fig. 15—Back-Tie Method.

opening water and acid will eat through the tape and attack the copper, converting it into copper sulphate.

Lead-covered cables have also been employed in several buildings as risers. In some cases the cable is inclosed in a length of conduit which extends 2 ft. below and 8 ft. above the floors on the side wall as a protection from mechanical injury, the cable for the rest of the distance to the ceiling being supported on knobs. In other cases the cable is closed in continuous conduit throughout all the risers. As a whole an open lead-covered installation is very undesirable.

Fittings best suited for the severe conditions encountered in packing house practice will be given consideration in the next article.

SMALL STRUCTURAL SECTIONS IN TRANSMISSION TOWERS.

The use of thin metal sections, even for compression values calculated in accordance with accepted formulas, was criticised by Mr. R. Fleming in a paper on "Steel Poles and Towers" read before the Association of Iron and Steel Electrical Engineers at Milwaukee on Oct. 3. It is not yet possible to state accurately the probable life of a steel tower, said the author, for it was only as far back as 1903 that the first high-tension transmission line was built in which steel towers were used exclusively. This was a line in Mexico 101 miles long, with towers about 450 ft. apart. The present practice of a multiplicity of light sections will not be conducive to long life. Sections 1/8 in. thick are very

common—more of this thickness than of any other are used in the average tower. Towers made of such material, galvanized at the shop, bolted together in the field and then left alone, cannot last for a long term of years.

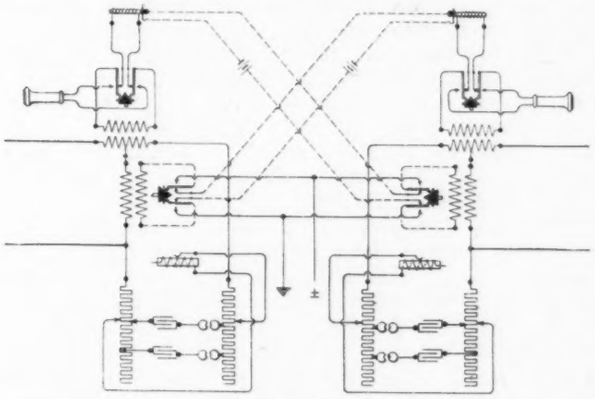
In a number of tower tests under the writer's observation the failure was always in the 4-in. x 4-in. x ¼-in. corner angle leg. These members were not good for their calculated value. This confirms Talbot and Moore in "An Investigation of Built-Up Columns Under Load," in which they write: "It would seem quite probable that, for columns of the same length and containing the same amount of metal, one which is of stocky form and in which the metal is distributed so as to resist local flexural and torsional action will be much stronger and more satisfactory than a column of more flimsy form which has its metal spread in thinner sections, even though the slenderness ratio l/r of the former may be considerably more than that of the latter."

Important changes will take place in the direction of thicker material after some of the present lines fail. The present policy of purchasing only what will answer for the immediate present will then be abandoned. There is no reason why a tower properly designed, inspected at regular intervals and painted when necessary, should not last at least fifty years.

RECENT TELEPHONE PATENTS.

REPEATER CIRCUIT.

A patent for a repeater circuit has been granted to F. J. Shubert, of Portland, Ore. This circuit is designed to eliminate humming and depends upon balancing the repeater coils between the corresponding line section and an



Repeater Circuit.

artificial line. The reinforcing coil is connected to the middle of the receiving-coil secondary. The operation may be readily understood with the aid of the diagram.

RINGING SYSTEMS.

Four patents have been granted to Mr. A. H. Weiss, of Wilmette, Ill., for automatic ringing circuits. These describe different applications of automatic ringing to operators' cords. The patents cover not only the system wherein the ringing must be initiated by the operator, by pressing a key, but also where the ringing commences automatically with the insertion of the calling plug. The notable feature of these systems is the introduction of a control relay, which operates at predetermined intervals to cause intermittent ringing. This is distinct from the usual method of introducing the "makes" and "breaks" directly in the ringing circuit. In one of the patents, however, the usual ringing-current interrupter is resorted to. These patents are all assigned to the Kellogg Switchboard & Supply Company.

A step-by-step method of selective signaling is described in a patent granted to Mr. J. McFell, of Chicago. He provides, at some convenient point in the line, a pole-changing station. At each of the various substations a sending device is arranged. The system is planned so that the tens digit may be sent first, followed by the units digit. The first operation is to set up both digits on the sender, at which time all substations and the pole-changing station are normal and the normal terminal of the battery is connected to line. When the sender is released impulses are generated and the tens side of the connector at each substation steps up one notch for each impulse. At the completion of this series a short delay permits the pole-changing station to reverse the line polarity, whereupon the units side comes into action and the desired units digit is stepped up. Each station corresponds to a definite angular displacement of both units and tens.

ATTACHMENTS.

Mr. H. G. Schwager, of Omaha, has also patented a receiver-supporting arm. A small angle piece is secured beneath the transmitter clamping nut of the desk stand and arranged to swing about the transmitter bolt so that the free end may be either horizontal or vertical. This end of the angle carries a swinging receiver-supporting arm. It will be understood that when the angle is turned so that the plane of the swinging arm is horizontal the free arm of the angle will rest upon the top of the transmitter clamp, in which position the receiver will be held at the ear of the user. When not in use the angle is turned through 90 deg., whereupon the pin in its free end receives a horizontal position, permitting the receiver-supporting arm to fall in a vertical plane, simultaneously with which a hook secured to the arm engages the hook switch of the set and depresses it.

Letter to the Editors

TELEPHONE PHENOMENA INVESTIGATION.

To the Editors of the Electrical World:

Sirs:—In addition to the remarks made in the editorial in the Sept. 14 number of the *Electrical World* referring to the experiments of Dr. Kennelly and Prof. Pierce, there are several fields in which investigations may be directed with profit as far as the telephone art is concerned. There is the "molecular-theory" telephone, referred to by Mr. H. R. Van Deventer on page 58 of his able book on "Telephonology," which avoids the magnetic-circuit principle. Efforts have also been made to utilize static electricity, but with little success. Another feature of interest not often considered by manufacturers or by many experimenters is the fact that the best results are not obtained by using the center of the diaphragm to give the necessary vibrations to the carbon in transmitters.

The great tendency of inventors to-day is to keep to the same principles as are embodied in the ordinary type of receivers and transmitters and improve the mechanical details, and hence so far as these types are concerned the telephone art is very highly developed. In view of the development of wireless and submarine telephony and the requirements for greater talking range by telephone, there is a great field for experiments and invention with substantial inducements ahead. It would seem advisable, however, to branch into other principles than those of the present magnetic telephone and the carbon transmitter, and also to try to combine both the transmitter and receiver in one instrument. The writer has always found his experiments on these lines interesting and valuable. He advises the use of the most delicate instruments obtainable for checking the results of all experiments.

Washington, D. C. A. P. Connor.

Digest of Current Electrical Literature

ABSTRACTS OF THE IMPORTANT ARTICLES APPEARING IN THE ELECTRICAL PERIODICAL PRESS OF THE WORLD

Generators, Motors and Transformers.

Current Rushes on the Connection of Transformers to the Line.—T. D. Yensen.—When a transformer is connected to the line there is a sudden current rush, and this may assume dangerous values, especially since alloy-steel sheets have been introduced in transformer construction and the magnetic density has been increased. The author gives the mathematical theory of these current rushes and shows that the theory is in excellent agreement with experimental oscillographs. These current rushes can be reduced so as to be harmless if in connecting the transformer to the busbars an ohmic resistance or an ironless inductance is connected in series with the primary. This resistance needs to be connected only for the first few periods and is then short-circuited. A very simple switch for this purpose is shown in Fig. 1. It is seen that when the switch is being closed the resistance R is for a moment in series with the primary of the transformer, but when it is completely closed so as to cross $A\,B$ the resistance R is short-circuited. This resistance or inductance must fulfil the equation $R = \omega L = \frac{1}{2}$ normal voltage at the terminals divided by

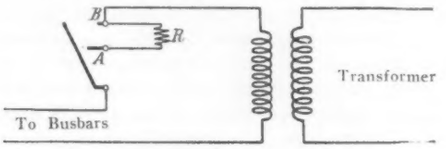


Fig. 1—Diagram of Connections.

full load current, where R is the ohmic resistance, ωL the inductive reactance, ω being 2π times the frequency.—*Elek. Zeit.*, Sept. 26, 1912.

High-Frequency Discharges in High-Tension Transformers.—A. J. Makower.—Owing to the capacity of the windings of high-tension transformers a breakdown of the insulation between the windings and the case is liable to set up high-frequency oscillations of a destructive nature in the transformer. The author has made some measurements to determine their value. A 2-kva, 40-cycle, oil-immersed transformer with a ratio of 100 to 4000 volts was connected to the supply circuit and a short air-gap connected between one end of the high-tension winding and the case. It was found that continuous sparking was set up across the gap when its length was reduced to about 1 mm, and that the oscillation frequency, measured by a tuning circuit containing a variable capacity, an inductance and a thermo-galvanometer, and loosely coupled to the oscillating circuit, was 4,130,000 cycles a second. The connections are shown in Fig. 2, in which w represents the high-tension winding, c the case and s the spark-gap. The low-tension winding is not shown. G, L and K are the galvanometer, inductance and variable capacity constituting the tuning circuit, which was loosely coupled to the oscillating circuit by means of a few turns of wire. When the transformer was excited so as

Fig. 2—Testing Circuits for One Transformer.

to give a secondary emf of 4000 volts it was found by means of an electrostatic voltmeter that the potentials between the free ends of the high-tension winding and the case were 2250 and 1790 volts respectively, and that there was practically no voltage between the middle point of the high-tension winding and the case. Thus, before any oscillations are set up, the full potential of the transformer is so distributed that a strain of about half the full voltage of the transformer exists between the ends of the high-tension winding and the case. From further measurements it follows that the emf between the high-tension and low-tension windings would be about 570 volts, and that between the low-tension winding and the case about 1430 volts. In extra-high-tension transformers it must therefore be of

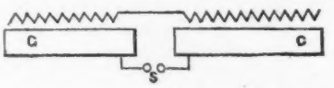


Fig. 3—Testing Circuits for Two Transformers.

great importance to provide very good insulation not only between the high-tension windings and the rest of the transformer, but also between the low-tension windings and the rest of the transformer. It must be supposed that the capacities that come into question for the high-frequency currents approach the values given above, as the high-frequency oscillations are not able to penetrate through the whole windings. Some special experiments made by the author show that the capacities that come into question for the high-frequency currents are only of the order of a hundredth part of the values measured by the ballistic galvanometer. Oscillations of the same frequency but of greater power than those obtained by the connections shown in Fig. 2 were obtained by the connections shown in Fig. 3, which represent two transformers similar to the one previously tested connected with their low-tension windings in parallel on the mains and the high-tension windings interconnected at one point; the connection between the high-tension windings is such that the voltage between the free ends of the two high-tension windings is the sum, and not the difference, of the voltages of the two windings. It was then found that sparks of more than a millimeter length could be taken off between the cases of the two transformers.—London *Elec. Review*, Sept. 27, 1912.

Frequency Changers.—C. Turnbull.—The author discusses the various difficulties underlying the use of frequency changers for coupling together networks of different frequencies, and finally describes briefly the frequency changer of the Lancashire Dynamo & Motor Company. This machine consists of a rigidly coupled motor-generator with the number of poles at either end requisite to deal with the frequencies concerned. The correction for small variations of either frequency is affected by rotating one of the stators. The stator in question is mounted on bearings and is given the necessary torque by means of a small motor geared to it. The result of this arrangement is that the stator is driven by the motor or else drives the motor at the speed required to compensate for variations in the speed of the prime movers which supply energy to the two systems coupled through the frequency changer, and it, therefore, keeps in step at both ends. Suppose, for instance, that the changer, running at 600 r.p.m., couples 50 to 60 cycles nominally, but that the actual periodicities are 49 and 61, then the stator will rotate at 22 r.p.m. to compensate for the difference. There will be no trouble in paralleling the two ends, for the stator will twist itself round so as to pull into step as soon as the second switch is closed. The author discusses whether such a changer should be designed as a synchronous or an induction machine, or whether one end should be synchronous and the other asynchronous. The synchronous set would operate with a good power-factor, which will nearly always be an important item; it will often happen that the receiving side will be able to accept current only at something like unity power-factor. Yet a syn-

chronous changer may have troubles of its own, especially if the variations in frequency on the two systems are excessive and violent. The changer may have to deal with sudden changes of frequency, such as happen when a large generator is switched in or out at either end, or when sudden loads are put on to the mains, such as railway trains, collieries, etc., while the effect of short-circuits on the mains may cause sudden alterations in frequency, which may pull a synchronous machine out of step. The troubles might be greatly aggravated where energy was delivered to a comparatively small supply which had a large proportion of spasmodic load on its mains. The remedy would be to use an induction set at one end, compensated for power-factor by an arrangement such as was recently described by Kapp. An alternative method would be to run up the motor as an induction machine and arrange its rotor windings so that continuous current could be put through one leg when it was nearly up to speed. It would then jump into step and run as a synchronous machine. The other windings could be short-circuited so that the rotor would run as an asynchronous set if it came out of phase, while at the same time it would come into step again if the load were not too heavy.—London *Electrician*, Sept. 27, 1912.

Temperature Compensation for Motors.—A note on a recent British patent (3107, Sept. 19, 1912) of Fried. Krupp, A. G. In order to render the working of a motor or other electrical machine independent of the effects of variation of resistance of the field-circuit due to temperature rise, an auxiliary resistance with a positive temperature-resistance coefficient is connected up in parallel with the field winding and a further resistance is placed in series. The resistance, temperature coefficients and thermal time-constant of the auxiliary resistors are so proportioned that, although less current flows in the system when the temperature rises, the proportion between the field winding and the parallel resistor is altered to an extent which insures an unaltered current through the field winding.—London *Elec. Eng'ing*, Sept. 26, 1912.

Lamps and Lighting.

Series Incandescent Lighting.—A note on a recent British patent (27,862, Sept. 12, 1912) of E. Booth and N. R. Booth. Edison screw-cap lamps are used. The end of the screw collar is spun over to form a flat disk having a central hole to allow the threaded part of the screw to pass through and yet leave a clearance. Inside the collar is a flat insulating washer, with a smaller central hole which will also allow the screw to pass through. Before the screw is put through the disk and washer, three washers are slipped over it. The first is of copper and bears against the head of the screw, the second is of lead and the third is of insulating material. On failure of the lamp the insulation is broken down.—London *Elec. Eng'ing*, Sept. 19, 1912.

Mercury-Vapor Lamp.—An illustrated article on the development and construction of the quartz-tube mercury-vapor lamp.—London *Electrician*, Sept. 20, 1912. An English translation of the German article by F. Girard on the quartz-tube mercury-vapor lamp for alternating currents is given in London *Elec. Review*, Sept. 20, 1912.

Generation, Transmission and Distribution.

Electric Winding Plant.—An illustrated description of an electric winding plant at the coal mines at Kippax, Yorks. Three-phase, 50-cycle currents are delivered to the substation at 10,000 volts to be reduced to 2000 volts for feeding the fly-wheel converter. The converter includes a 300-hp motor, operating on the 2000-volt three-phase supply circuit, within speed limits of 730 and 640 r.p.m., allowing a slip of 12 per cent; this machine is coupled on one side to an interpole generator, giving a pressure range of from + 500 to — 500 volts, and a 9-ton flywheel, and on the other side to a small exciter, the latter being sufficient for the excitation of the generator, and of the two winding motors with a drop in speed to 500 r.p.m. With this drop in speed a full wind could be performed even if the energy supply were cut off. The flywheel is calculated to deliver 5580 hp-seconds with a slip of 12 per cent. The winding engine has a drum 11 ft. in diameter and 6 ft. 8 in. wide, and is coupled to an interpole winding motor on either side. Either motor can, in case of emergency, continue winding operations with reduced loads. The normal speed is 71 r.p.m. and the maximum rope speed is 12.5 m per second, the motors being of the interpole type, shunt-wound and arranged for reversing. The slip regulator is of the liquid type, the electrodes in the tank being lifted or lowered according to the load by means of a small series induction motor mounted on the top, which is operated from a three-phase series transformer in the main supply circuit to the converter motor. The transformer has three terminals for each phase to allow of adjusting the current at which the slip regulator works, and thus regulating the maximum power taken from the mains in conformity with the required output of the winding plant.—London *Elec. Review*, Sept. 27, 1912.

Rolling Mills.—A. Reisset.—The first part of an illustrated paper on the electric driving of rolling mills.—*La Lumière Elec.*, Sept. 21, 1912.

Traction.

Chicago.—Eighty pages of text and forty-eight plates of beautiful illustrations on transportation conditions in Chicago, with special articles on the operations of the companies under the 1907 ordinances, on track and overhead construction, on training employees, on carhouse design and practice, on rolling stock standards, on power generation for electric traction, on the railway power consumption system of the Commonwealth Edison Company, on the duties and organization of the Board of Supervising Engineers, on a study of electrification of railway terminals, on the Chicago freight subway and on electric interurban lines serving the city of Chicago.—Convention Issue, *Electric Railway Journal*, Oct. 5, 1912.

British Municipal Tramways Association.—A report of the eleventh annual conference of the British Municipal Tramways Association held at Westham. The presidential address by Mr. H. E. Blain dealt with the corrugation problem, recent British legislation on tramways, telephone lines, rating of tramways, and omnibus competition. A paper by Mr. S. C. T. Neumann dealt with "tramway administration by municipalities—a retrospect and a forecast," a paper by Mr. William J. McCombe with "tramway fares and their basis." A preliminary report was presented by a special committee appointed to inquire into the phenomena of corrugation of tramway rails (abstract will appear in the *Digest* in a subsequent issue).—London *Electrician*, Sept. 27, 1912.

British Tramway Account.—An abstract of last year's financial statement of the municipal tramways of Lincoln, England. For the first time since these tramways were converted to electrical working, six years ago, the accounts of the undertaking have shown a profit. The "GB" surface-contact system is used. There has been a material decrease in the cost of repairs to the "GB" equipment, but the total is still slightly above the average annual amount guaranteed by the installing company. Repairs have been confined to small renewals and replacements of live and dead studs, worn studs and studs broken by heavy tractors. The traffic expenses and energy expenses per car-mile have slightly increased; the general expenses have been decreased by 0.16 cent per car-mile, the total repairs and maintenance by 0.2 cent and the total capital charge by 0.04 cent. The total expenses per car mile were 19.82 cents (against 20.02 cents the year before). The total revenue was 20.24 cents (against 19.56 cents).—London *Electrician*, Sept. 27, 1912.

Surface-Contact System.—For comparison with the returns of the Lincoln Municipal Tramways, where the "GB" system is used (see preceding abstract), an account is given of the Wolverhampton Corporation Tramways, in which

the Lorain surface-contact system has been in operation for eleven years. The total expenses per car mile last year were 17.94 cents against 17.72 cents the year before. The total revenue was 22.24 cents against 21.30 cents the year before. The figures of Lincoln and Wolverhampton are not strictly comparable, since the weight of the cars in the two cases is not the same and the Wolverhampton undertaking is much larger, so that certain charges are distributed over a greater mileage.—London *Electrician,* Sept. 27, 1912.

Railless Traction.—An illustrated article on railless electric traction in Dundee.—London *Electrician,* Sept. 27, 1912.

Marine Propulsion by Electric Transmission.—Henry A. Mavor.—An illustrated British Association paper in which the author after describing the electric propulsion equipment of the United States collier *Jupiter* and the tests he saw carried out on this equipment gives particulars of the installation that is being constructed for the *Tynemount,* an electrically propelled vessel for service on the Canadian lakes.—London *Electrician,* Sept. 27, 1912.

Installations, Systems and Appliances.

Electric Industry in South America.—L. W. Schmidt.—A statistical article on the development of the market for electrical products in South America, with figures on the exports from the United States, England and Germany to Brazil.—*Elek. Zeit.,* Sept. 26, 1912.

Wires, Wiring and Conduits.

German Association of Electrical Contractors.—An account of the tenth annual convention of the German Association of Electric Wiring Contractors held in June in Frankfort. Hohnof spoke on the training of electric wire men, Nolzen and Baumann dealt with the regulations of the electricity works. The secretary reported on labor questions, and new proposals concerning ways of meeting strikes were adopted. The growth of transmission systems in agricultural districts and the question of an electric monopoly were also subjects of discussion. Kuckuk discussed the possibility of uniform prices in the electric wiring industry. —*Elek. Zeit.,* Sept. 12, 1912.

Fuses.—Hundhausen.—An illustrated article giving some new proposals for a system of non-interchangeable fuses for all purposes.—*Elek. Zeit.,* Sept. 12, 1912.

Electrophysics and Magnetism.

Photo-Electric Cells.—J. W. Woodrow.—A note on a spontaneous electromotive-force in cells of alkali metals. In working with photo-electric cells it was found that when the cell was insulated in the dark the alkali metal would develop a negative charge. From the results given in the present paper it seems that some sort of positively charged particles are given off by the alkali metals in a high vacuum. —*Phys. Review,* September, 1912.

Electrochemistry and Batteries.

Electric Precipitation of Suspended Particles.—Linn Bradley.—A paper read before the International Congress of Applied Chemistry on recent progress made in the development of the Cottrell process, with special reference to the precipitation of smoke and cinders, the application in smelting electrolytic slime, the condensation of acid mist, the precipitation of smelter fumes and the purification of illuminating gas.—*Met. and Chem. Eng'ing,* October, 1912.

Electric Precipitation of Suspended Matter in Gases.—W. W. Strong.—A Franklin Institute paper in which the author reaches the following conclusions: The effect of the polarization of suspended particles in a gas results in the aggregation of the particles and increases the ease with which the suspended matter can be removed from the gas by settling or by centrifugal means. Suspended particles in a gas can be ionized and may then be removed from the gas by the action of the electric field. Examples are given of the ionization of particles of various kinds of spray and dust. It is shown how various kinds of smoke-deposit patterns are formed by electric fields that are not intense enough to produce secondary ionization and ionic streams. The presence of suspended particles in a gas increases the rate of recombination of the ions in the gas. Smoke or fumes thus greatly reduce the ionization of gases coming from furnaces, and this reduces the ionic current between spark electrodes placed in the gas. This property of smoke or fumes may be used to indicate their presence in a gas. One of the most effective actions of an electrical discharge in precipitating suspended matter from a gas is that of the force acting upon the suspended particles due to the ionic currents flowing through the gas. These ionic currents are produced by the action of the electrical field upon the ions formed by secondary ionization. The secondary ionization may be produced by a point or by a corona discharge. A brief account is given of the plants that have been built for precipitating the fumes from copper smelters and the dust from cement plants. An account is also given of the experiments made by the writer upon the precipitation of carbon smoke.—*Jour. Franklin Inst.,* September, 1912.

Units, Measurements and Instruments.

Sensitive Relay.—An illustrated description of the "K K detector" invented by von Kramer and G. Kapp, which is a very sensitive relay whereby very feeble electrical impulses can be magnified. In principle the K K detector (Figs. 4 and 5) consists of: (a) A steel reed, securely fixed at one end, with a natural frequency corresponding to that of the alternating-current circuit on which the instrument has to operate. (b) A permanent-magnet steel frame, of which the steel reed forms one polar extension, the free end of the reed therefore having the characteristics of one pole of a permanent magnet of the same polarity as the limb of the magnet to which it is fixed. (c) A laminated soft-iron wire core of square section attached to the other end of the steel frame of the permanent magnet and forming the other polar extension (Fig. 5). The two ends of the laminated core are of the same polarity, but of opposite polarity to the free end of the reed, only a small air gap being left between the core extremities. The free end of the steel reed lies in the center of this air gap, and therefore an equal attraction exists between the reed and the two limbs of the laminated core. Provisions are made whereby the total air gap between the two limbs of the core, or the gap between either limb and the steel reed, can be increased or decreased, as may be necessary to meet the purposes for which the relay is employed. A magnet coil is mounted on each limb of the laminated core, both coils being so connected that on passing an alternating current through them their magnetism is superposed on that of the permanent magnet at the core extremities, the alternations of this superposition corresponding to the frequency of the circuit; for example, on a 100-cycle circuit the polarity is built up and reversed 100 times per second at each extremity. The reed, having the same periodic time as the vibrating field in the air gap, is attracted by the one and repulsed by the other core ex-

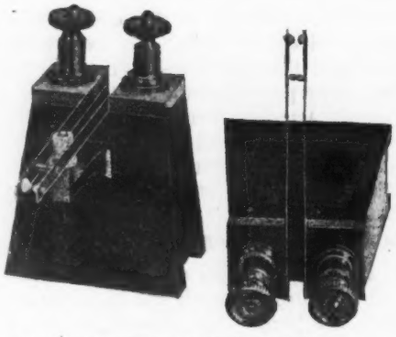


Fig. 4—Vibrating Parts of Detector.

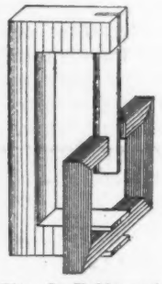


Fig. 5—T-Magnet System.

tremity when even the most feeble current is passing through the coils. This vibrating reed is thus utilized to operate a contact device. The reed does not directly "make" the local circuit, but simply actuates a mechanical contact "breaking" device, which consists of two parallel non-magnetic flanking reeds of much lower periodic time than the steel reed. The ends of the flanking reeds are fixed to insulated metal supports which carry terminals. Each flanking reed is fitted with a platinum block, the two blocks being opposite to and pressing against each other. Between the two reeds an insulated ivory roller is placed. The steel reed is suspended vertically between and at right angles to the free ends of the horizontal flanking reeds. At the end of each flanking reed an insulated ivory point is fixed, the air gap between the points being such that the steel reed is free at the commencement of its excursion to attain sufficient momentum forcibly to strike against the ivory points, thus separating the platinum blocks and keeping them apart as long as the reed continues to vibrate. This ivory roller prevents the delay in the separation of the platinum blocks which would otherwise result from the spring effect in the reed necessary to maintain the contact between the platinum blocks. The two flanking reeds with their platinum contact blocks form part of the local circuit and act as a single-pole switch. On an alternating current of 100 cycles per second the instrument will respond to currents of 2×10^{-4} amperes at an emf of 2×10^{-2} volts.—London *Electrician*, Sept. 20, 1912.

Production of a High Potential for Electrometer Work.—A. H. Forman.—An abstract of an American Physical Society paper. It is often desirable to obtain a high potential which will be constant enough not to disturb an electrometer, as when one wishes to hold an ionizing chamber at a high potential and measure the leakage in this chamber with a Dolezalek electrometer. A simple method is to use a series of condensers and a source of low emf such as a storage battery. The condensers are permanently connected in series and then separately charged in succession from an insulated source of constant emf. This charging in succession is done by means of a rotating contact maker. It consists of a drum with as many pairs of contacts as there are condensers in series. These contact points are staggered on the drum so that only one pair is connected to a condenser at one time, but each pair is always connected to the source of emf through slip rings on the drum. In this way as the drum is rotated it connects each condenser in succession across the source of emf, and the faster it is rotated the oftener they are charged. Since the source of emf is insulated, any point in the series of condensers can be made to have zero potential by grounding it. This will then give any other point in the series a definite absolute potential. And the total difference in potential of the series is equal to the number of condensers times the emf of the course. Also, since each and every condenser is charged for every revolution of the drum, if the speed of rotation is enough the condensers are kept fully charged. The scheme not only gives a steady potential but it affords a means of calibrating static high-potential instruments, the ratio of transformation in this case being equal to the number of condensers employed, since they are always connected in series.—*Physical Review*, September, 1912.

Telegraphy, Telephony and Signals.

Telephone-Cable Boxes with Constant High Insulation.—A. Ebeling and R. Deibel.—In view of the small amounts of energy used in telegraph and telephone transmission it is very important that the insulation be excellent. It is not so much in the lines themselves that insulation difficulties appear, since with cables insulation values of several thousand megohms per km (1 km = 0.6 mile) can be easily obtained, but the trouble is with the cable boxes, which often reduce the high insulation value of the line to fractions of a megohm. The chief object must be to make the insulation as independent as possible of humidity in the air and of temperature variations. Tests made by the authors show that the solid insulating materials so far employed in telephone-cable boxes are either greatly dependent on the weather and the humidity or affected by variations of temperature. These troubles can be overcome by using oil for insulation. It would, of course, be practically impossible to make all the connections in oil. But since the experiments of the authors show that the leakage occurs over the surface of the insulating materials where the conductors pass through it is sufficient to cover this surface with a thin film of oil while the cable ends are several centimeters above the level of the oil. Various designs of cable boxes, etc., embodying this principle are described and illustrated. The system has been developed by Siemens & Halske.—*Elek. Zeit.*, Sept. 26, 1912.

Book Reviews

Primer of Scientific Management. By Frank B. Gilbreth. New York: D. Van Nostrand Company. 103 pages. Price, $1.

A very interesting and entertaining little work is this primer. The author is well known as an advocate and exponent of the Taylor system of economizing effort in industry. He is also a contractor and man of affairs; so that he is eminently capable of discussing his subject from both the theoretical and practical sides. It appears that after Dr. Taylor published a series of magazine articles on "The Principles of Scientific Management" hundreds of letters came to the publishers from the readers, asking for further information and propounding conundrums. These were all handed to Mr. Gilbreth, who here publishes them with their answers, in a selected order. This gives to the book a curious question-and-answer appearance, calling to mind some of the old-fashioned scientific primers. Nevertheless, this peculiar presentation has marked advantages, especially because it condenses the comments, queries and objections into a very brief array.

There is probably no question of great national and even international importance so pregnant with consequences to the average citizen as that of the management of industrial labor, dealt with in this primer. Perhaps the whole future of civilization turns upon the question as to whether the doctrines here expounded shall succeed or fail. The book will interest not only employers and the employees of large-scale industry, but also the average voter, the householder and the man of business.

* * *

Les Rayons Ultra-Violets et Leurs Applications. Paris: Librairie du Mois Scientifique et Industriel. 62 pages, 44 illus. Price, 2.75 francs.

A pamphlet on the production and practical applications of ultra-violet rays, especially in relation to mercury-vapor lamps. Ordinary ultra-violet rays are defined as those existing in sunlight, in the rays of arc lamps protected by glass globes and by the mercury-vapor lamps in glass. Medium ultra-violet rays are those produced by the naked carbon arc or by mercury-vapor lamps in quartz tubes. Extreme ultra-violet rays are those produced by flaming arcs between iron or aluminum electrodes or by Geissler tubes in quartz.

In the second chapter are described the various mercury-vapor lamps used for the production of ultra-violet rays. Chapter III describes the application of ultra-violet rays to the sterilization of liquids. Chapter IV deals with the therapeutic applications of ultra-violet rays. Chapter V finally discusses several miscellaneous applications. The pamphlet is interesting not merely for its clear descriptions, but also for its systematic arrangement and presentation.

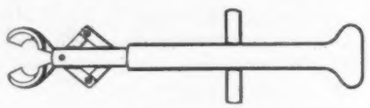
New Apparatus and Appliances

REGULATOR FOR SMALL ELECTRIC APPARATUS.

A 5-in. regulator electric heating device, etc., for use with small motors has been placed on the market by the Cutler-Hammer Manufacturing Company, of Milwaukee. It is provided with a three-step adjustment and an "off" point and is operated by a small lever extending from the back of the inclosing case. This lever is so arranged that it sits squarely over the contacts which are mounted on the back of the porcelain base. The resistors are completely covered by cement and a black-japanned metal case incloses and protects the entire unit. It has a dissipating capacity of 60 watts and can be provided with a total resistance of 1200 ohms maximum.

SAFETY FUSE PULLER.

The Barry non-shock fuse puller, made by the Electric Device Manufacturing Company, Rochester, N. Y., comprises an insulating handle with an adjustable tong grip, capable of holding and pulling a wide range of cartridge-fuse diameters. The puller is made in two sizes, for 1-amp



Safety Fuse Puller.

to 60-amp and 60-amp to 100-amp fuses respectively. With this tool, it is declared, a fuse can be pulled or put in "hot" while the operator is standing in a damp or conductive place, with as great ease and safety as if a glass-insulated platform were used. The movable cross-piece permits a firm grasp to be taken on the fuse cylinder, and the device gives full protection against burns or shocks.

MOTOR-DRIVEN GEARLESS AIR COMPRESSOR.

A triple-cylinder, motor-driven, gearless air compressor for electric railway cars has been placed on the market by the Allis-Chalmers Company. It weighs 390 lb. complete and has a capacity of 18 cu. ft. of free air per minute against a pressure of 90 lb. per square inch. The 600-volt, four-

A Gearless Air Compressor.

pole, direct-curent, inclosed series motor is designed for a speed of 1150 r.p.m. and its armature is mounted on a sleeve which is keyed to the crankshaft and held in place by lock nuts. An armature may be replaced in a few moments without removing the compressor from the car. The armature coils are wound with comparatively heavy wire and extra allowance has been provided for slot insulation.

Intake valves of the sleeve type are mechanically actuated by means of eccentrics on the crankshaft. This construction, it is claimed, allows the use of large intake ports and high speed, also reducing the noise of operation to a minimum. The cylinder heads may be removed independently without disturbing the intake or discharge piping. Access to the crank case may be had by means of a cover plate on the side opposite the cylinders. The crankshaft is made of high-carbon, heat-treated steel, and the steel connecting rods are provided with phosphor-bronze bushings. Lubrication in the crank case is effected by the splash system, but barriers are provided to keep the oil from entering the motor. Only two bearings are required to support the shaft. The makers claim that exhaustive tests of this type of compressor show exceptionally high volumetric and over-all efficiencies.

LAMP CHEST FOR AUTOMOBILES.

There has been placed on the market by the Elux Miniature Lamp Works of the General Electric Company, 324 Lafayette Street, New York, N. Y., an automobile lamp chest containing trays in which a full complement of lamps for the automobile is stored. The set comprises bulbs for two head-lamps, two side-lamps, tail-lamp and meter-lamp. The advantage of this arrangement resides in the importance of having lamps of the correct voltage for the system on which they are to be used. The chest is of suitable size and shape to fit into an ordinary automobile tool box.

DEMONSTRATION OF LOW-VOLTAGE LIGHTNING ARRESTER.

A novel and ingenious demonstration of the need of lightning-arrester protection for overhead electrical circuits was made at the recent Chicago convention of the American Electric Railway Manufacturers' Association by the Electric

Transparent Painting Showing Lightning.

Service Supplies Company, of Philadelphia. The central point of interest in the exhibit was the large framed water-color painting illustrated herewith. This represented a typical section of interurban railway, with transmission line and feeders, and an electric car in the foreground. Alongside this painting, mounted on a pole, was a 500-volt Gorton-Daniels direct-current lightning arrester.

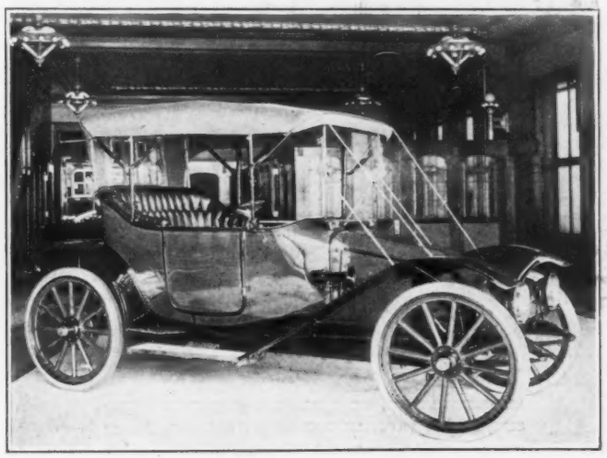
Behind the picture was a box containing high-candle-power electric lamps, condensers, etc., while beneath the box suitable sources of supply for 500-volt direct current and high-frequency static electricity were placed. Both sources of energy were necessary—the former to illustrate the action of the arrester in interrupting the flow of line current to ground following the lightning discharge, and the latter to superimpose static stresses across the arrester between line and ground.

In operation a spark from the condensers crossed the air gap of the arrester, establishing the dynamic direct-current arc, and at the same time caused a bright and realistic flash of "lightning" to cross the picture. This flash took the form of a heavy direct stroke, striking the line in its passage to ground, together with many secondary flashes of lesser brilliance and intensity.

The novelty of seeing a realistic imitation of lightning in conjunction with a typical electric railway scene, and at the same time seeing the lightning arrester operate simultaneously with the flash, attracted much favorable comment and proved to be a unique method of demonstrating this class of protective apparatus.

ELECTRIC ROADSTER.

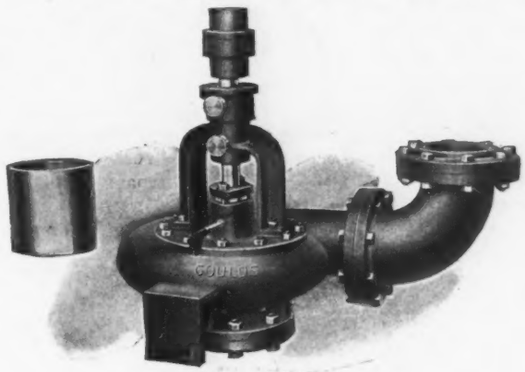
An electric roadster built along lines rather different from those of any other electric vehicle on the market is shown herewith. It is of the torpedo type, with the body placed low between the axles. The wheel base is 110 in. and use is made of 38-in. by 4-in. artillery wheels. The battery is composed of forty-cells of medium-thin Exide plates, housed under the front hood. The battery contains forty cells, as in ordinary direct-current charging that number of cells has proved to be the most economical for this size car. The battery is divided into halves for series-parallel operation, so that the low speeds are permanent running speeds, with all cells drawn upon equally, and no energy is wasted in resistors. The motor is of the medium-speed, four-pole series type built by the Westinghouse Electric & Manufacturing Company. It is of ample size to drive the car under any road conditions in summer or winter. The motor is said to possess high efficiency during overload and to have a remarkably low energy consumption. The roadster is said to be capable of going over 100 miles on a charge, its speed being 25 miles an hour. It is equipped with such devices as interlocking foot-control, non-reversible wheel-steering apparatus, bevel-geared drive, double internal-expanding safety brakes, Krupp silico-manganese steel springs and others. It is manufactured by the Argo Electric Vehicle Company, Saginaw, Mich.



Electric Roadster.

VERTICAL CENTRIFUGAL PUMP.

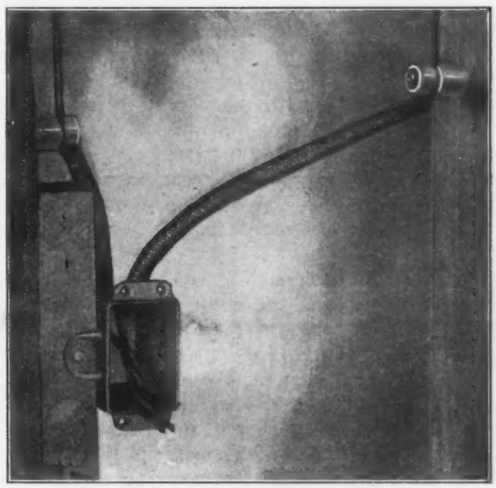
A new vertical-type centrifugal pump has been added to the line of centrifugal pumps developed by the Goulds Manufacturing Company, Seneca Falls, N. Y. It is particularly adapted for pumping from a pit and it can be operated submerged when desirable. The impeller is of the inclosed type and the design is such that the end thrust is practically negligible. A ball thrust bearing carries the weight of the impeller and shaft. A water-sealing ring is provided, making it unnecessary to draw the gland up tight, insuring low friction losses. For special liquids which attack iron this pump can be furnished brass-fitted or made entirely of brass. It is adapted for belt drive or direct connection to electric motors.



Vertical Centrifugal Pump.

A CONVENIENT SWITCH BOX.

A switch box recently developed and placed on the market by the George Cutter Company, 403 Notre Dame Street, South Bend, Ind., is so constructed that its installation necessitates only the following operations: Drive a nail in the studding where the box is to be located, then slip the slotted lug over the nail. Push the box back so that the front lug is flat against the studding, drive a nail through it and no amount of rough handling can put it out of shape.



Method of Supporting Switch Box.

Fig. 1 shows a front view of the box and Fig. 2 one method of supporting it. The box is made of cast iron with a slotted lug at the back to hold it rigid and true perpendicularly and with another lug at one side of the front which holds it firmly in place, thus eliminating the necessity of cross-pieces, etc. The knockouts in the top and bottom are made for either loom or flexible or rigid conduit.

ARTISTIC PORTABLE LAMP.

The portable lamp here shown is made entirely of Veluria glass and is provided with a small lamp wired in series in the base so that the entire unit glows when the lamp is in service. The unit is of pure white alabaster when cold, but when lighted the glass takes on a faint blush or "fire" that is pleasing and altogether unusual. The decorations on the base and shade are deeply etched and give the lamp character and richness. This lamp is now being offered by the Nelite Works of General Electric Company for the holiday trade.

Portable Lamp.

ALTERNATING-CURRENT NETWORK PROTECTOR.

The alternating-current network protector herewith illustrated has been designed to disconnect a defective transformer instantaneously, thus protecting the secondary network by preventing an overload on the remaining transformers and consequently any interruption of the service. The device is entirely electrical, being free from moving parts, and requires no adjustment or attention. In principle it is a series transformer possessing three windings—a primary connected in series with the primary of the step-down or service transformer, a secondary connected in series with the secondary of the service transformer, and a tertiary or auxiliary winding consisting of a few turns of heavy wire so designed that the ratio of current that will flow in them during short-circuits is high as compared with the current in the other coils. The primary and secondary windings of the device are provided with the same ratio of turns as the primary and secondary of the step-down transformer with which it is to be used. The protector is connected in line with the step-down transformer, so that during normal operation the currents in its primary and secondary windings oppose each other in direction, and as the ratio of the windings in the device and in the step-down transformer are equal, the excitation in the two windings of the device is also equal, and, the latter being connected in opposition, no current is produced in the short-circuited coil. A diagram of connections for a three-wire secondary main is shown in Fig. 2. One terminal of the primary of the step-down transformer is connected in series with the primary winding of the device. The terminals of the secondary of the step-down transformer are connected to the distribution main through the secondary windings of the device, as shown. In the engraving it will be noted that there are two V-shaped fuses, the bottoms of which are connected to the outer wires of the three-wire secondary network. One of the upper prongs of each of the fuses is connected to the end of its respective secondary coil, while the other prong of each of the fuses is attached to the third and heavy auxiliary winding as shown. The fuses act as a short-circuit connection on these auxiliary secondary coils, and the function of the combination is such that under normal conditions the currents in the primary and in the secondary coils of the protective device neutralize each other, so that there is no mmf circulating in the core of the series transformer to energize the auxiliary or heavier secondary winding. This balance is maintained at all loads and is upset only by a reverse current from the secondary network into the transformer, such as is occasioned by a short-circuit in the latter. This condition immediately reverses the relative polarity of the secondary coils, thus energizing the core and causing a heavy short-circuit current through the heavier or auxiliary secondary winding by way of the short-circuiting fuses. The short-circuit current through the fuses immediately ruptures them and isolates the main terminals so that the defective transformer is instantly cut out and disconnected from the line, thus permitting the remaining transformers connected to the network to continue their function of taking up the load of the defective transformer, without any resultant interruption to the service. The device is made by the Metropolitan Engineering Company, Brooklyn, N. Y.

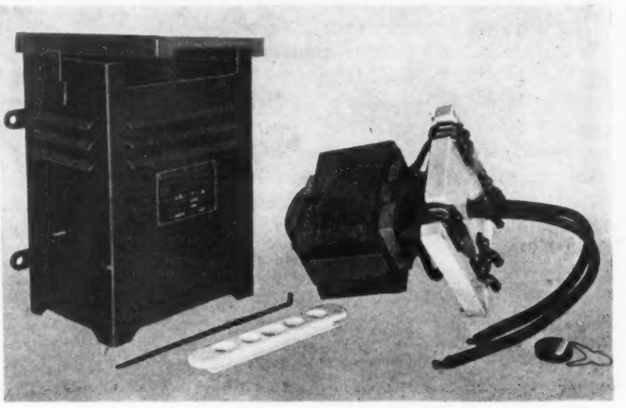


Fig. 1—Alternating-Current Network Protector.

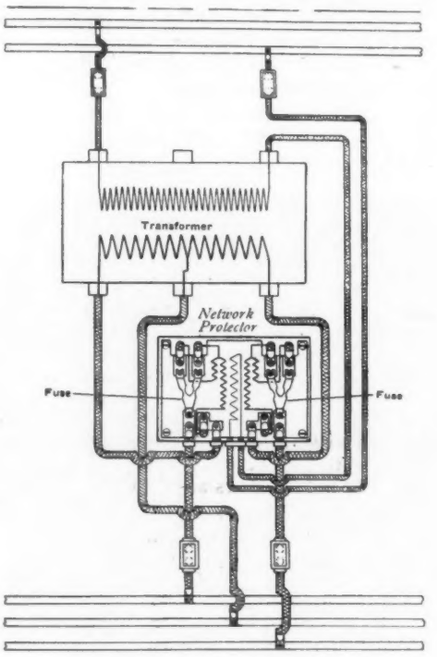


Fig. 2—Diagram of Connections.

Industrial and Financial News

SHORTAGE of labor and railroad cars and the ascending tone of the metal markets at present are among the signs of industrial expansion. Inquiry for iron and steel and for building materials of all kinds is broadening rapidly and new construction projects are exceedingly numerous. Securities of public-utility companies are in brisk demand despite the high rates for call money that have prevailed in recent weeks. New issues are being absorbed rapidly and the outlook for still broader purchasing of these issues is considered to be very favorable. Among the new offerings of the week are the securities of the Utilities Improvement Company and those of the Utah Securities Company, the formation of which is noted below. That an excellent volume of business is being done in the electrical industry is shown in the fact that the aggregate pay roll of the three largest American electrical manufacturers is now running close to $1,300,000 per week, which is some $250,000 larger than the weekly total last January and compares with less than $1,000,000 per week during the industrial activity of 1906.

To Finance Public Utilities in the West.—A syndicate headed by the Electric Bond & Share Company and Hayden, Stone & Company has organized the Utah Securities Corporation under Virginia laws to finance water-power and other public utility properties in Utah and elsewhere in the West. As was forecast in these columns last week, the Utah Securities Corporation has acquired practically all the outstanding securities of the Telluride Power Company. It has also acquired the Utah Power Company, which has taken over the Knight Consolidated Power Company, the Davis & Weber Counties Canal Company and the securities of several other companies operating electric lighting properties in Utah, Colorado and southern Idaho, following negotiations referred to in the *Electrical World* July 27 and Aug. 17. The syndicate has underwritten the Utah Securities Corporation's present proposed issue of $25,000,000 ten-year collateral trust notes and $27,500,000 stock. The first instalment of 30 per cent on notes issued has already been called, and at the present time about $9,000,000 of these notes have been issued and paid for. The balance will be issued as additional funds are required by the corporation. The voting trustees of the Securities corporation are: S. Z. Mitchell, president Electric Bond & Share Company; Charles Hayden, Hayden, Stone & Company; James Campbell, president North American Company; R. E. Breed, president American Gas & Electric Company, and J. R. Nutt, president Citizens' Savings & Trust Company, Cleveland. All of the operating properties controlled by the corporation are being merged into a new corporation to be known as the Utah Power & Light Company, and the bonds and preferred stocks of this company will be sold later. The proceeds will be deposited with the trustee and will be used from time to time for the retirement of the present issue of the Utah Securities Corporation's notes. Earnings of the operating properties for the year ended June 30, 1912, after deduction of gross charges, are given as $1,094,692, and net earnings as $633,035. These figures do not include any revenues from the Davis & Weber Counties Canal Company.

Going Ahead with Long Acre Company Plans.—Control of the stock of the Long Acre Electric Light & Power Company of New York has been transferred from John C. Sheehan and allied interests known as the Manhattan Transit Company to the banking houses of A. B. Leach & Company and Harvey Fisk & Sons, and new officers for the electric company have been elected as follows: President, P. G. Gossler, of A. B. Leach & Company, succeeding James F. Shaw; vice-president, H. L. Denny, succeeding John C. Sheehan, and secretary and treasurer, E. W. Bell, succeeding O. B. Corbin. New directors have been chosen as follows: Pliny Fisk, A. B. Leach, P. G. Gossler, H. L. Denny, G. P. Toby, A. A. Tilney and E. W. Bell. This reorganization strengthens the statements made recently by interests associated with the Long Acre company, to which reference was made in these columns Oct. 5, that the purchase by a stockholder of the Consolidated Gas Company of a majority of the Long Acre company's first-mortgage bonds, the interest on which is in default, would not cause any changes in the plans that had been made to establish the Long Acre company as a competitor of the New York Edison Company. A. B. Leach is quoted as saying that the new bondholders cannot foreclose if the company pays its debts, and that it is going to pay them. Pending the outcome of litigation before the Appellate Division of the Supreme Court, in which the New York Edison Company is opposing the action of the Public Service Commission for the First New York District in giving authority to the Long Acre company to operate in the city, details of the financing and engineering plans are withheld.

Acquires British Canadian Power Company.—The Northern Ontario Light & Power Company, Ltd., Toronto, has taken over the properties and assets of the British Canadian Power Company. Payment for the property is to be made by $2,000,000 first-mortgage 6 per cent twenty-year gold bonds of the Northern Ontario company, dated April 1, 1911. These bonds have been underwritten by London and Montreal bankers and will be offered shortly for public subscription. The Northern Ontario company was organized in February, 1911, under Ontario laws, and acquired the Cobalt Power Company, Ltd., and its subsidiaries; the Cobalt Hydraulic Power Company, Ltd., and the Cobalt Light, Power & Water Company, Ltd. Its authorized capital stock is $5,000,000 common and $2,500,000 6 per cent cumulative preferred. Of this $3,085,000 common and $1,800,000 preferred are outstanding. Generating stations owned by the company include a 4000-hp hydroelectric plant at Hound Chute Falls, on the Montreal River, near Cobalt, and six auxiliary stations with an aggregate rating of 6500 hp at High Falls. Its president is David Fasken, of Toronto. M. A. Viele, of New York, is vice-president, and these two, with Alexander Fasken, of Toronto; F. W. Stehr, of New York, and Lionel Davis, are directors.

La Crosse (Wis.) Water Power Company Sold.—The property of the La Crosse (Wis.) Water Power Company, which controls the Winona (Minn.) Railway & Light Company, and for which receivers were appointed in August, 1911, following financial difficulties due to small rainfall in Wisconsin in 1910, as previously noted in these columns, has been sold at public auction to Frederick Vogel, Jr., president of the First National Bank of Milwaukee and chairman of the bondholders' committee of the La Crosse company. The price paid for the property is given as $500,000. In addition to its inability to meet bond interest due April 1, 1911, due to low water, as mentioned above, the company has been greatly handicapped since its dam at Hatfield, on the Black River, Wis., was wrecked in the flood of Oct. 6, 1911, details of which appeared in the *Electrical World* Oct. 14, 1911, page 924. Repairs have been made, and the company is now in a position to continue its affairs as soon as reorganization is completed.

Chicago Gas and Electric Combination Rumor Denied.—Rumors of an amalgamation of the gas and electric-service interests of Chicago have appeared at intervals for several years. A story of this kind was printed in great detail in a Chicago paper on Oct. 10, in which the Insull interests were reported as effecting a combination along the lines suggested above. Samuel Insull, who was in New York at the time, telegraphed a prompt denial to his secretary in Chicago. "The story is entirely without foundation," he said. "I am not in New York to see any of the People's Gas interests, and I am not engaged, directly or indirectly, in any negotiations to acquire the People's Gas Light & Coke Company." It is also stated that an authorized representative of the gas company has affirmed that no negotiations of the kind are pending.

Initial Dividend Declared.—The Brazilian Traction, Light & Power Company, Ltd., whose formation was noted in these columns June 29, has declared an initial dividend of 1½ per cent on the $104,500,000 stock, for the quarter ending Oct. 31.

Utilities Improvement Company Organized.—Details of the new holding corporation for gas and electric properties that Henry L. Doherty & Company have been forming since last summer, to which reference was made in these columns Aug. 10, were made public this week. The new concern is known as the Utilities Improvement Company. It has been organized under Delaware laws and has an authorized capitalization of $25,000,000 6 per cent cumulative preferred stock and $15,000,000 common stock, and $10,000,000 of each class is to be issued immediately. The proceeds of the sale of the preferred and common stocks issued and sold at this time will be used to acquire the following properties and securities: Toledo Railways & Light Company; Danbury (Conn.) & Bethel Gas & Electric Light Company; Brantford (Ont.) Gas Company; Woodstock (Ont.) Gas Company, Ltd.; Athens (Ga.) Railway & Electric Company; Coshocton District Gas & Fuel Company, Ohio; Bartlesville (Okla.) Gas, Electric & Railway Company; Empire Gas & Fuel Company, Kansas, Missouri and Oklahoma; $2,800,000 six-year 7 per cent notes of the Southwestern Reserve Gas Company. As these and other properties to be acquired are developed they will be turned over to the Cities Service Company or to the Consolidated Cities Light, Power & Traction Company. The Utilities Improvement Company will be under the management and operation of the Doherty Operating Company. Its officers and directors will be: President, Henry L. Doherty; vice-presidents, Frank W. Frueauff and Charles T. Brown; general manager, Holton H. Scott; secretary, Paul R. Jones, and treasurer, Louis F. Musil; W. F. Hoffman, president Commercial National Bank, Columbus, Ohio; Leslie M. Shaw, president First Mortgage Guaranty & Trust Company, Philadelphia; James Mitchell, of Sperling & Company, London; W. W. Foster, New York, and James Satterfield, Dover, Del. An offering of stock in the new concern is now being made by H. L. Doherty & Company.

Toledo Railways & Light Reorganization Plan.—The committees representing the bond and stock holders of the Toledo Railways & Light Company have agreed upon a plan for reorganizing of the company. The new company will have an outstanding capital of $22,000,000, as follows: First lien secured notes, $6,000,000; second lien secured notes, $1,200,000; preferred stock, $6,800,000, and common stock, $8,000,000. The par value of the securities to be taken over by the new company is somewhat in excess of $32,000,000. In addition to taking over the Toledo Railways & Light Company, the new company will also take over the securities of the Maumee Valley Railway & Light Company, the Toledo, Ottawa Beach & Northern Railway Company, the Toledo & Western Railway Company, and the Adrian Street Railway Company, now owned by the Toledo Railways & Light Company. Stockholders of the latter are given the privilege of paying $7.50 a share, for which they will receive $7.50 in the preferred stock and $43 in common stock of the new company. In case they do not care to subscribe to the new plan under these terms, they will receive $13 in the common stock of the company for each $100 of stock in the old company. Henry L. Doherty & Company will underwrite the subscriptions expected from the stockholders and will assume the supervision and management of the properties for five years.

Inquiry for Cleveland Municipal Lighting Bonds.—James A. Hutchinson, bond dealer of Boston, has written City Auditor Coughlin, of Cleveland, Ohio, asking whether the $1,500,000 municipal light bonds as yet unsold can be purchased at private sale and whether they can be sold below par. Mr. Coughlin states that they can be purchased at private sale, but the city must realize par value for them. The city is proceeding with the construction and equipment of the plants from funds received from the sale of $500,000 bonds sold to the city sinking fund commission. Bids recently opened for the three turbines to be installed in the new municipal electric-light plant were as follows: Allis-Chalmers Company, $149,700; General Electric Company, $154,000; Westinghouse Electric & Manufacturing Company, $165,526. The lowest bid on the six 1000-hp boilers, $83,858, was made by the Babcock & Wilcox Company. Contracts will be awarded shortly.

Plan Extensive Hydroelectric Developments at Windsor Locks, Conn.—The expenditure of about $5,000,000 for hydroelectric developments at Windsor Locks, Conn.; navigation of the Connecticut River as far north as Holyoke, Mass., by means of a barge canal around the dam which is to be built at Windsor Locks, and the construction of an auxiliary steam station to supplement the hydroelectric development mentioned above, are among the plans which the Stone & Webster interests will carry out in New England. The Connecticut River Company is to be absorbed by the Northern Connecticut Power Company, which is to be incorporated in Connecticut with a capital of $7,000,000.

Recent Dominion Power & Transmission Company Changes.—The board of directors of the Dominion Power & Transmission Company, Hamilton, Ont., Can., on Oct. 9 made the following appointments: Managing director, William C. Hawkins, formerly secretary and general manager; general manager, Edward P. Coleman, formerly manager of railways; general superintendent of light and power, William G. Angus, formerly electrical engineer of the railway division; general superintendent of railways, George E. Waller, who has held the position of general freight, passenger and claim agent of the Dominion company's railway department.

Manhattan Electrical Supply Company Increases Capital Stock.—Stockholders of the Manhattan Electrical Supply Company, 17 Park Place, New York, have authorized an increase in the capital stock of the company from $750,000 to $5,000,000. The directors have decided upon a 100 per cent stock dividend. In addition to this they have made an allotment of stock to be sold to employees at not less than par. The increase has been made with the intention of enlarging both the manufacturing and distributing facilities of the company. Announcement of the date on which the dividend will be paid and of closing of the books will be made hereafter.

Merchants' Heat & Light Company Bonds.—An offering of $2,255,000 refunding-mortgage 5 per cent ten-year gold bonds of the Merchants' Heat & Light Company, of Indianapolis, is being made by Lee, Higginson & Company at 97½ and interest, to yield more than 5.30 per cent. This company, as was noted in these columns Sept. 28, has been reorganized, and controlling interest in it has been vested in a new holding concern, the Merchants' Public Utilities Company. The Merchants' Heat & Light continues operation as a separate concern.

Otis Elevator Business Shows Increase.—All of the plants of the Otis Elevator Company in this country are understood to be operating at full output, and that in Berlin is also operating on a satisfactory scale. The business of the company this year is at a much larger rate than that in 1911, and from present indications, 1912 will be the best year in the history of the company. Contracts recently closed by the company call for elevators in all parts of this country and for numerous installations abroad.

New England Telephone & Telegraph Bonds.—A block of $10,000,000 5 per cent twenty-year gold bonds of the New England Telephone & Telegraph Company was offered this week by Kidder, Peabody & Company, of Boston and New York, at par and accrued interest. The total debt of the company, including this issue of bonds, amounts to $12,500,000, and the present capitalization to $43,061,600. Net earnings in the year ended Dec. 31, 1911, was $3,130,803.

McCrum-Howell Subscriptions Large.—Subscription payments to the new stock of the McCrum-Howell Company, in accordance with the reorganization plan recently noted in these columns, are understood to be coming in on a very liberal scale. Many of the larger stockholders have paid their share or have signified their willingness to do so before the time to participate in the plan expires.

Evansville (Ind.) Public Utilities Merger Approved.—A demurrer of the Public Utilities Company of Evansville, Ind., to the suit seeking dissolution of the merger of the Evansville and Southern Indiana Traction Company and the Evansville Gas & Electric Light Company and the Evansville Public Service Company has been sustained.

Burlington (Wis.) Company Reported Sold.—It is reported that the Burlington Light & Power Company of Burlington, Wis., a city of 3500 inhabitants about 35 miles southwest of Milwaukee, has been sold to the recently organized Wisconsin Gas & Electric Company, reference to which appeared in these columns Oct. 5 and 12.

Reorganization of Platt Iron Works Company Completed.—On June 22 there appeared in these columns a statement to the effect that ample working capital and adequate funds for future development had been provided for the Platt Iron Works Company of Dayton, Ohio, through a reorganization plan that would be adopted by a majority of the creditors of the company. The latter, as is well known, manufactures air compressors, blowers, feed-water heaters, pumps, etc. The reorganization plan referred to above has now been declared operative, and as a result a new company, recently incorporated under Maine laws, has taken over the physical assets, inventory and other properties of the former company and is carrying on the business under the same name, free from all floating indebtedness and with a working capital of $700,000. Its president is J. B. Reichmann, and the other officers are: E. F. Platt, vice-president and treasurer; J. F. Hartlieb, vice-president, and John Sturgess, secretary. Waddill Catchings, president of the Central Foundry Company, New York, is chairman of the board of directors. The capitalization of the new company consists of $1,100,000 non-cumulative preferred stock, $1,000,000 common stock and $700,000 6 per cent twenty-year gold bonds. The entire organization of the former company, including the engineering force, superintendents and foremen in the production department, has been kept intact. Improvements and betterments costing about $50,000 are now under construction.

Allis-Chalmers Assessments.—The second instalment of the assessments on the preferred and common stocks of the Allis-Chalmers Company was payable on Oct. 16. After this payment, $7 on the common and $14 on the preferred will be forthcoming. The company's orders for power transformers in the past four weeks were the largest in its history.

INDUSTRIAL SECURITIES.

Security.	Capital Stock Listed.	DIVIDEND.		QUOTATION.	
		Per Cent.	Period.	Oct. 9.	Oct. 16
Allis-Chalmers t. r. 1st assess. paid	$17,125,800	.....	.....	¾*	½
Allis-Chalmers pf.	2,083,800	.....	.....	2½	2*
Allis-Chalmers pf. t. r. 1st assess. paid	13,966,200	.....	.....	3½	3½*
Amalgamated Copper	153,887,900	1	Q	89½	89½
American Tel. & Tel.	334,303,300	2	Q	143½	143½
Crocker-Wheeler, c.	1,700,000	1½	Q	89*	88*
Crocker-Wheeler, pf.	500,000	1½	Q	104*	105*
Electric Storage Battery, c.	16,074,425	.....	.....	56½	56
General Electric	77,726,700	2	Q	183½	182½
Mackay Cos., c.	41,380,400	1¼	Q	87*	86¾*
Mackay Cos., pf.	50,000,000	1	Q	68¼*	68¼*
Western Union Tel.	99,743,400	¾	Q	81½	79
Westinghouse E. & M., c.	31,685,300	1	Q	84½	84½
Westinghouse, E. & M., pf.	3,998,700	1¾	Q	126*	126*

*Last price quoted.

NEW YORK METAL MARKET PRICES.

	Oct. 9 Bid.	Oct. 9 Asked.	Oct. 15 Bid.	Oct. 15 Asked.
Copper:				
Standard, spot	17.25	.....	17.20	.....
	£ s d		£ s d	
London, standard, spot	77 2 6		75 7 6	
Prime Lake	17.70 to 17.75		17.62½ to 17.75	
Electrolytic	17.70 to 17.75		17.50 to 17.70	
Casting	17.50		17.37½ to 17.50	
Copper wire, base	19.00		19.00	
Lead	5.10		5.10	
Nickel	45.00		45.00	
Sheet zinc, f.o.b. smelter	9.00		9.00	
Spelter, spot	7.65		7.60	
Tin, spot	49.75		49.35	
Aluminum:				
Prompt delivery	25.50 to 26.50		26.00 to 27.00	
Future	25.00 to 26.00		25.50 to 26.50	

OLD METALS.

Heavy copper and wire	17.00	16.25
Brass, heavy	10.25	10.25
Brass, light	8.75	8.75
Lead, heavy	4.75	4.75
Zinc, scrap	6.25	6.25

COPPER EXPORTS IN OCTOBER.

Total tons, week ending	Oct. 8, 6,452	Oct. 15, 12,301

Personal

Mr. E. A. Wright has resigned his position with the Allis-Chalmers Company, Norwood, Ohio, to become manager of the Manhattan Ice, Light & Power Company, of Manhattan, Kan.

Mr. William G. Angus, formerly assistant to the general manager of the Dominion Power & Transmission Company, Hamilton, Ont., has been appointed general superintendent of the lighting department of that company.

Mr. Frank G. Baum, who has been consulting engineer for the Pacific Gas & Electric Company, of San Francisco, Cal., has accepted the position of chief engineer of construction for that company. Mr. Baum will carry on the work projected by the late James H. Wise.

Mr. Francis Waller Harris, until recently general manager of the Consolidated Light & Power Company, Ronceverte, W. Va., has been appointed general manager of the Beacon Light Company, Chester, Pa., which is owned and controlled by the Philadelphia Electric Company.

Mr. F. C. Clark has been appointed chief engineer of the Toronto (Ont.) Railway, the Toronto Power Company and the Electrical Development Company of Ontario, to succeed **Mr. W. H. Fisher,** who has been acting temporarily since Mr. W. B. Boyd resigned a short time ago.

Dr. William Marconi, who met with an automobile accident which caused an injury to one of his eyes, the condition of which was reported as improving, as noted in recent issues, is still unable to see with the injured eye, and doubt is being expressed as to the recovery of sight.

Mr. G. T. Simpson has been appointed contract agent for the Des Moines Electric Company, succeeding **Mr. J. L. Bradfield,** who resigned to engage in commercial work in Seattle, Wash. Mr. Simpson was formerly specialties engineer for the St. Paul (Minn.) Gas Light Company.

Mr. F. S. Johnson has been appointed superintendent of the Rocky Ford (Col.) division of the Arkansas Valley Railway, Light & Power Company. This division comprises Rocky Ford, Fowler, Manzanola and vicinity. Mr. Johnson was formerly connected with the new-business department of the company.

Prof. O. J. Ferguson, who succeeds **Prof. G. H. Moore** as head of the department of electrical engineering at the University of Nebraska, Lincoln, comes from the faculty of Union College, Schenectady, N. Y. He is a 1903 graduate of Nebraska, and after leaving school entered the apprenticeship course of the General Electric Company at Schenectady. Prof. Moore retires to do private professional work.

Mr. Frank E. Watts, the newly elected Jupiter of the Jovian order, was born in Sunbury, near Columbus, Ohio, thirty-four years ago and was educated in the Columbus public schools. He has been connected with the incandescent-lamp business for about five years and is now manager of the Eastern branch of the Sunbeam lamp department of the Western Electric Company, with headquarters at New York. Mr. Watts served as statesman for New York last season under Tenth Jupiter Jaynes. He organized and was largely responsible for the marked success of the Jovian Lunch Club in New York City. Mr. Watts lives at West Orange, N. J., and is a member of the Essex County Country Club.

FRANK E. WATTS.

Mr. Wentworth P. Johnson has been appointed manager of the New York office of H. M. Byllesby & Company. For the last nine years he has been the European financial

agent of the International Harvester Company, residing in London. He is an old friend and business associate of Mr. Byllesby, having been connected with the old Northwest General Electric Company, of St. Paul, Minn., a number of years ago. Mr. Johnson was born in Norfolk, Va., in 1859.

Mr. H. T. Edgar, formerly manager of the Seattle Division of the Puget Sound Traction, Light & Power Company, has been appointed district manager of all of Stone & Webster's properties in the Central Western States. Mr. Edgar's headquarters will be in Boston and he will have charge of the properties at Houghton, Mich., Paducah, Ky., and the great hydroelectric plant now under construction on the Mississippi River at Keokuk, Iowa. Before going to Seattle he was in charge of Stone & Webster's properties at Fort Worth and El Paso, Tex., and still earlier held a similar position at Lowell and Brockton, Mass.

Mr. Karl E. Eriksson, of Stockholm, Sweden, has arrived in this country for the purpose of studying American practice in high-tension engineering. He is a graduate of the Royal Technical Institute of Stockholm, and was engaged there as instructor in the department of electrical engineering during the years 1908-1912. During the last two years he has also been retained by the Swedish patent office as expert on electrical matters. He has conducted research work pertaining to high-tension phenomena and has written a number of articles on corona effects, protection of high-tension lines and other matters of a theoretical character, all of which have been published in the organ of the Swedish Technological Society.

Gen. George H. Harries, who retired last month as president of the Association of Edison Illuminating Companies, was elected president of the American Electric Railway Association in Chicago on Oct. 10. He is a man of many responsibilities, being president of the Louisville Gas Company, Arkansas Valley Railway, Light & Power Company and the Fargo & Moorhead Street Railway Company, as well as vice-president of the Northern State Power Company, Minneapolis General Electric Company and the Consumers' Power Company of Minneapolis. All the companies named are controlled by H. M. Byllesby & Company. General Harries is also a member of the public policy committee of the National Electric Light Association and belongs to several other societies. For several years he was a public service operator in Washington, D. C., and in 1910 he was president of the Washington Board of Trade.

Mr. Kern Dodge, who has recently opened an office in Philadelphia, where he will make a specialty of the engineering and financing of public-service properties, as announced in our issue of Oct. 12, was born in Chicago, Ill., on July 20, 1880. His education was acquired at the Germantown (Pa.) Academy and the Drexel Institute, Philadelphia, his family having moved to the latter city during his boyhood. His father, Mr. James Mapes Dodge, was president of the American Society of Mechanical Engineers, 1904-1905. Kern Dodge, having inherited his father's engineering tastes, entered the course in mechanical engineering at Drexel Institute, and soon after his graduation became chief electrician of the Link Belt Engineering Company. In 1902 he became associated with Mr. Charles Day under the firm name of Dodge & Day, consulting engineers, making a specialty of construction work for industrial plants and railroads. Mr. Dodge is a member of the Union League, Engineers', Automobile and Germantown Cricket Clubs, the Franklin Institute of Philadelphia, the American Institute of Mechanical Engineers, the New York Electrical Society and the Aero Club of America.

KERN DODGE.

Mr. Martin Schreiber, who was elected president of the American Electric Railway Engineering Association at its convention in Chicago last week, was born in Ironton, Ohio. He obtained his early education in civil engineering by association with his father, who was a general contractor. He was graduated from the Ohio State University in 1899 with the degree of mechanical engineer. From that time until 1903 he was connected with the Cleveland Electric Railway and at the time he went to the Public Service Corporation of New Jersey he was engineer of power-house design and construction. His first position with the Public Service Corporation of New Jersey was that of assistant engineer, and in 1905 he acted as engineer in charge of the design and construction of the Plank Road shops, Newark, N. J., being at present engineer of maintenance of way to the Public Service Railway, of Newark, N. J. His other society memberships include the American Society of Civil Engineers, the American Institute of Electrical Engineers, the American Society of Testing Materials, the National Electric Light Association and the New York Railroad Club.

Mr. C. G. M. Thomas, who was elected president of the Empire State Gas & Electric Association at its meeting held in New York on Oct. 9, as announced in last week's issue, was born in New York City on July 2, 1866, of Welsh parentage. His education was acquired in the public schools of the city and in the College of the City of New York. From 1884 to 1888, when he entered the employ of the Standard Gas Light Company of New York, he was engaged in the fire insurance business. He continued with the gas-light company until 1901, during which period he filled various posts, being intrusted with the management of the company's offices and distribution departments in the territory known as the Harlem district, the Columbus district and in the Bronx from about 1893 up to the time he severed his connection with the company. While with the gas company he was also president of the New Paltz & Wallkill Valley Railroad, which operated a trolley from Poughkeepsie to New Paltz. He was also vice-president and treasurer of the Middletown-Goshen Traction Company in Orange County. Mr. Thomas was elected vice-president and general manager of the Newtown-Flushing Gas Company in 1901, now known as the New York & Queens Gas Company. During this same period he was vice-president and general manager of the Williamsport (Pa.) Gas Company and of the Dallas (Tex.) Gas Company. Mr. Thomas gave up all of these interests in 1907, when he was elected vice-president and general manager of the New York & Queens Electric Light & Power Company, Long Island City, N. Y., which position he still holds. He is also a director of the New York & Queens Gas Company and the New York & Queens Electric Light & Power Company, in addition to being connected with a number of financial and industrial concerns in Flushing, N. Y. Mr. Thomas is also a member of many fraternal and social clubs. In the public-utility field he is a member of the American Gas Light Association, the Ohio Gas Light Association, the National Electric Light Association, the Illuminating Engineering Society and the Empire State Gas and Electric Association.

C. G. M. THOMAS.

Obituary

Mr. William P. Abbey, formerly president of the Sunderland (Mass.) Electric Light & Power Company, died suddenly at his home in North Sunderland, Mass., on Oct. 5. He had been ill for a short time with rheumatism, but heart trouble, probably induced by rheumatism, caused his death. Mr. Abbey was born in Sunderland on Aug. 1, 1876. In addition to his business interests Mr. Abbey was active in civic and church affairs. He was actively interested in the electric company until quite recently.

Construction

BIRMINGHAM, ALA.—The Birmingham Ry., Lt. & Pwr. Co. is planning to build a substation on the North Birmingham line. The cost of the equipment is estimated at about $30,000.

GADSDEN, ALA.—Plans have been prepared by the Alabama Pwr. Devel. Co. for the construction of a 10,000-kw steam plant here. A power station 150 ft. x 160 ft., of concrete and brick, costing $300,000, will be erected. The work will be done by the company. Sargent & Lundy, Railway Exchange, Chicago, Ill., are consulting engineers.

HUNTSVILLE, ALA.—Extensive improvements will be made to the local power plant, railway and equipment of the Alabama Interstate Pwr. Co., involving an expenditure of about $50,000.

SPEIGNER, ALA.—The power house for the power plant at the prison cotton mill at Speigner's has been completed and machinery will be installed as soon as the dam is completed. The proposed plant will have an output of about 160 hp.

TUSCALOOSA, ALA.—Preparations are being made by the Birmingham & Gulf Railway & Nav. Co., for equipping its tracks in this city for electrical operation. The power house will be located at Riverview, east of the city.

TUCSON, ARIZ.—The Tucson Farms Co., which is building a large irrigation system near Tucson, is planning to install three power plants at the head of the ditch.

WILLIAMS, ARIZ.—The Williams Wtr. & El. Co. has applied to the State Corporation Commission for permission to issue bonds to the amount of $250,000 for the purpose of installing a new electric-light plant and water-works system. The Williams Company has taken over the property of the Grand Canyon El. Lt. & Pwr. Co.

ARKANSAS CITY, ARK.—A committee has been appointed by the City Council to look into the question of establishing a municipal electric-light plant, water-works and sewerage systems.

NEWPORT, ARK.—The plant and holdings of the People's Lt., Wtr. & Pwr. Co. have been purchased by the Co-operative El. Co., which was recently granted a franchise here. The consideration is said to be about $25,000. H. B. Crossland is interested in the Co-operative company.

BAKERSFIELD, CAL.—Surveys have been completed for the transmission line of the Pacific Lt. & Pwr. Co. from its No. 2 plant in Crane Valley above Fresno to Los Angeles. The cost of the plant in Crane Valley and transmission line is estimated at about $6,000,000. The Stone & Webster Engr. Corp., Boston, Mass., has the contract.

BANNING, CAL.—Investigations are being made by W. E. Boden and H. S. Williamson, representing Redlands capitalists, with a view of establishing an electric-light plant here.

BERKELEY, CAL.—Four ordinances calling for bond elections have been put into circulation under the auspices of the Municipal League of California, one of which calls for an issue of $475,000 in bonds for a municipal electric-light plant; another for $800,000 for a municipal deep-well water supply to be operated by electrically driven machinery.

CAMPTONVILLE, CAL.—F. S. Labodie is contemplating the installation of a small lighting plant on his hotel grounds here.

FRESNO, CAL.—Preliminary arrangements are being made and the right-of-way secured for the construction of an electric railway from Fresno to Barstow Colony and Lathrop. J. B. Rogers, of San Francisco, is interested.

LOS ANGELES, CAL.—The city is planning to install a larger lighting system in the North Broadway tunnel.

LOS ANGELES, CAL.—Plans are being prepared by R. H. Manahan, city electrician, for the installation of ornamental street lamps on Sixth, Seventh, Eight and Ninth Streets and on Hill Street and San Pedro Street. Pedestals similar to those on Spring Street will be used. The total length of the new lighting system will be over 8 miles.

OROVILLE, CAL.—The Pacific Gas & El. Co. is planning to erect a transmission line into Oroville and to install a transforming station and distributing system in this district.

RIVERSIDE, CAL.—The City Trustees are considering the purchase of water rights of Prof. C. G. Baldwin in Mill Creek.

SAN DIEGO, CAL.—Proposals will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until Nov. 1, for an electric passenger elevator in the United States post office and court house, San Diego, in accordance with drawings and specifications, copies of which may be obtained at the above office. Oscar Wenderoth is supervising architect.

SAN FRANCISCO, CAL.—At an election to be held in December the proposition to issue $6,000,000 in bonds for the installation of a municipal telephone system will be submitted to a vote.

SAN FRANCISCO, CAL.—The contract for wiring the reinforced concrete hotel building being erected on Mason Street by William F. Wilson, of 135 Stevenson Street, San Francisco, has been awarded to the Central Electrical Plumbing & Heating Co. for $4,450.

SAN FRANCISCO, CAL.—The United Railroads of San Francisco has advised the Board of Supervisors that the overhead high-tension wires on Fillmore Street would be placed in conduits in Webster Street from Turk Street to Broadway by July 1, 1913. The cost is estimated at $60,000.

SAN JOSE, CAL.—The Southern Pacific Co. is contemplating equipping one of its steam roads for electrical operation between San José and San Francisco or building a complete new electric system between these points.

VALLEJO, CAL.—The Vallejo & Northern El. R. R. Co. has been granted permission by the State Railroad Commission to issue bonds to the amount of $5,500,000 for extensions of its line from a point near Vallejo to Sacramento, a distance of 58 miles. This line will be finished by the fall of 1913. It is proposed to build several branches, bringing the total mileage to 119 miles on the northern division.

TRINIDAD, COL.—Interests connected with the Central Park Amusement Co. are contemplating the organization of a company to build a large electric plant, to cost $60,000, at the edge of Central Park and to operate an electric railway in Trinidad and to the surrounding coal camps.

MERIDEN, CONN.—Bids will be received by the town school committee, City Hall, Meriden, until Nov. 1, for erecting complete a high school building. Bids may be submitted for the entire work or separately for the following items: Heating and ventilating, plumbing, electric work and general construction. Plans and specifications may be seen at the office of the committee and also at the office of Guilbert & Betelle, 665 Broad Street, Newark, N. J. Copies of drawings and specifications may be secured from the architects upon deposit of $50. Denis T. O'Brien, Jr., is clerk of committee.

WINDSOR LOCKS, CONN.—Negotiations have been closed whereby the Coffin interests in the Connecticut River Co. have united with the Northern Connecticut Securities Co. in the formation of a new $7,000,000 corporation to build a dam and new locks at Windsor Locks, about 4½ miles below the present Enfield dam. The new company asks for a federal charter for carrying out its plans, which will include a new dam, to develop about 35,000 hp, dredging of the Connecticut River north of Hartford and the opening of navigation with Springfield and Holyoke. An auxiliary steam plant will be erected on the tidewater and transmission lines will be erected throughout the State of Connecticut.

GAINESVILLE, FLA.—The City Council has engaged an engineer to prepare plans and specifications, estimates of costs, etc., for the proposed electric-light plant for which bonds to the amount of $35,000 have been voted.

JACKSONVILLE, FLA.—The Jacksonville Interurban Ry. & Tunnel Co. is planning to construct tunnels under St. James River from Jacksonville to South Jacksonville, and to build an electric railway from Jacksonville to Pablo Beach and St. Augustine, a distance of 45 miles.

NARCOOSSEE, FLA.—The installation of an electric-light plant in the Runnymede Hotel is contemplated. Jacob Yung is manager.

ATLANTA, GA.—Bids are being asked by the Board of County Commissioners for electric wiring, steam heating and plumbing for the Fulton County court house.

MEIGS, GA.—The City Council has awarded a contract for the installation of a municipal electric-light plant here, to cost about $21,000.

SAVANNAH, GA.—Sealed proposals will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until Nov. 6 for a conduit and wiring system, gas piping and lighting fixtures in the United States custom house, etc., Savannah, Ga., in accordance with drawings and specifications, copies of which may be obtained at the above office or at the office of the custodian, Savannah. Oscar Wenderoth is supervising architect.

WAYCROSS, GA.—Application has been made to the City Council by George W. Deen for an electric-light franchise.

CARROLLTON, ILL.—Bids opened by the City Council for motor and other machinery for the city water-works pumping station included an offer from the Central Illinois Public Service Co. to furnish electricity to operate the pumping station at 2.96 cents per kw-hour under a 10-year contract.

CHICAGO, ILL.—Sealed proposals will be received at the office of the business manager of the Board of Education, 730 Tribune Building, Chicago, until Oct. 23, for electrical work, telephones and bells for the Ravenswood School, Paulina Street and Montrose Avenue; also for electrical work for the C. A. Thorpe School, West Foster Avenue, near Lincoln Avenue, in accordance with plans and specifications prepared by A. F. Hussander, acting architect of the board, and N. L. Patterson, acting chief engineer, which may be seen at the office of the architect, 741 Tribune Building.

CHICAGO, ILL.—Plans are reported to be under way for an entrance of the Illinois Trac. System into Chicago by the way of Joliet, Hinsdale, LaGrange and Berwynn, forming an interurban chain between St. Louis and Chicago. To carry out the project it will be necessary to build 32 miles of new road.

CHICAGO, ILL.—Sealed proposals will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until Nov. 4, for installation complete of an electric passenger elevator in the United States Marine Hospital, Chicago, Ill., in accordance with drawings and specifications, copies of which can be obtained at the above office or at the office of the custodian, Chicago. Oscar Wenderoth is supervising architect.

DEKALB, ILL.—The City Council has appropriated $1,600 to be placed with a fund of $3,200 by the Commercial Club for the installation of ornamental lamps on Main Street. Arrangements for the installation of the lamps will be made by the light committee of the Council and a committee of the Commercial Club.

GILMAN, ILL.—The City Council has granted the Union Central El. Co. a 30-year franchise to erect and maintain an electric-light system in Gilman. A contract for street lighting is contemplated and incandescent lamps may be substituted for arc lamps now in use.

HARVARD, ILL.—The North Shore El. Co., of Chicago, has purchased the property of the Harvard Lt. & Pwr. Co.

HILLSBORO, ILL.—The directors of the Hillsboro El. Lt. & Pwr. Co. have voted to increase the capital stock of the company from $100,000 to $500,000 and to change the name of the company to the Central Illinois Utilities Co. Transmission lines will be erected from Hillsboro to Greenville, touching Coffeen and Donnellson, and later from Greenville to Gillespie, and another line to Fillmore. The company has closed a contract with the Village Board at Coffeen to furnish electricity for lighting the streets of the village.

HUNTLEY, ILL.—The Village Board has granted the Western United Gas & El. Co., of Aurora, a 50-year franchise to operate in Huntley.

IPAVA, ILL.—The Village Board has granted a 50-year franchise to a company said to represent the Commonwealth Edison Co. For the present the company will operate the local plant, but on Sept. 1, 1913, it will establish a 24-hour service. Forty-seven 40-watt tungsten lamps will be installed.

McLEAN, ILL.—The Village Board has entered into a contract with the Atlanta El. Lt. & Pwr. Co. for lighting the streets of the village. The company will also supply electricity for lamps and motors here.

MARSHALL, ILL.—Plans are being considered for the installation of an ice and cold-storage plant here; also to furnish electricity for lighting the city, for power purposes and to operate the water-works pumping station. C. G. Hallauer, of Arcola, is interested in the project.

MORRISON, ILL.—The City Council has appointed a committee to report as to the feasibility of establishing an electric-light plant in connection with the water-works station to supply electricity for lighting the streets and operating the pumping station.

MOUNT STERLING, ILL.—E. V. Graham, representing a syndicate which has an option on the local electric-light plant, has applied to the City Council for a new 50-year franchise.

CHESTERTON, IND.—Bids are being asked by the Chesterton & Moore's Hill Tel. Co., Chesterton, for material, equipment and labor for the construction of a telephone system in Dearborn County.

COLUMBUS, IND.—The Citizens' Tel. Co. will soon ask for bids for furnishing and installing a new switchboard in Columbus. Other telephone equipment will be purchased.

GOSHEN, IND.—Plans have been agreed upon for the complete remodeling of the municipal electric-light plant.

GREENFIELD, IND.—Bids will be received by the County Commissioners of Hancock until Nov. 8 for the installation of pedestal lamps around the Court House Square; also for a gasoline lighting system at the County Poor Asylum. Lawrence Wood is county auditor.

DES MOINES, IA.—Sealed proposals will be received at the office of the Adjutant General, Des Moines, until Oct. 25 for furnishing materials and constructing an electric signal and telephone system at the State Rifle Range, near Mid River Station, about 12 miles north of Iowa City. Plans and specifications may be seen at the above office or at the office of Prof. J. B. Hill, Iowa City, engineer.

MARSHALLTOWN, IA.—J. C. Young, of the Iowa Ry. & Lt. Co., has submitted a plan for the installation of an ornamental street-lighting system on South Third Avenue, to cost about $2,000.

OSKALOOSA, IA.—The Oskaloosa Trac. & Lt. Co. has increased its capital stock from $300,000 to $500,000. W. W. Williams is president.

REDFIELD, IA.—At an election held recently the proposition to issue $15,000 for the installation of an electric-light plant and water-works system was carried.

CORYDON, KY.—The Board of Aldermen has adopted a resolution to submit the proposition to issue bonds for the construction of an electric-light plant on Nov. 5.

VERSAILLES, KY.—The Versailles El. Lt. Co. is planning to establish a 24-hour service in the near future.

ALEXANDRIA, LA.—The committee appointed by the Council to look into the matter of furnishing electricity for lighting the town of Pineville has reported in favor of the project. Two plans were submitted, which will be referred to the Town Council of Pineville.

DONALDSONVILLE, LA.—Plans are being considered for improvements to the municipal electric-light plant and water-works system. It is proposed to substitute gas engines for the steam engines now in use. Charles Maurin is Mayor.

DEXTER, MAINE.—The Street Lighting Commission has entered into a contract with the Central Maine Pwr. Co. for lighting the streets of the town for a period of five years, under which the company agrees to furnish 100 lamps at $1,200 per year. The street lamps now in use will be replaced with tungsten lamps.

BALTIMORE, MD.—Samuel T. Williams, 223 North Calvert Street, Baltimore, it is reported, would like to receive prices on a 100-kw generating unit with engine, belted or direct-connected, direct or alternating current, 110 to 120 volts.

CENTERVILLE, MD.—The plant of the Centerville Lt., Ht. & Pwr. Co. has been purchased by the town of Centerville to be owned and operated by the municipality. The price paid for the plant was $9,250.

DEAL ISLAND, MD.—The Eastern Shore Lt. Ry. & Pwr. Co. has applied to the Public Service Commission for permission to issue $1,000,000 in capital stock and general mortgage bonds to the amount of $1,000,000. The company has been granted a charter to build and operate an electric railway in Somerset and Worcester Counties and also to supply electricity for lighting purposes. Senator Lewis M. Milbourne is president of the company.

BOSTON, MASS.—Mayor Fitzgerald will soon take up the question of improving the methods of lighting the principal squares of the city with the Edison El. Illg. Co.

BOSTON, MASS.—The New England Tel. & Teleg. Co. has sold $10,000,000 in bonds, the proceeds to be used to pay off the present floating indebtedness and to provide for extenslons and improvements in the company's service during the year 1913.

BOSTON, MASS.—The stockholders of the Boston & Providence R. R. Co. have voted to equip the railroad for electrical operation between Boston and Providence, and have authorized an issue of bonds not exceeding $8,000,000 for the purpose of providing funds to equip the main line.

DIGHTON, MASS.—The Selectmen have granted the Fall River El. Co., Fall River, a franchise to supply electricity in Dighton.

EAST LONGMEADOW, MASS.—The Central Massachusetts El. Co. has purchased a site here, on which it will erect a substation.

ORANGE, MASS.—The towns of Orange and Athol are considering the question of extending the lighting system along the entire distance of the main road between the two towns. The Orange system extends nearly 2 miles along the road and from Athol it extends about 1½ miles.

WEST SPRINGFIELD, MASS.—The Boston & Albany R. R. Co. contemplates the construction of an addition to its power plant here, to cost about $30,000. F. B. Freeman, of Boston, is engineer.

BAY CITY, MICH.—The Valley Home Tel. Co. has asked the City Council to grant certain changes in its franchise. If they are granted, the company agrees to erect a new plant, at a cost of about $150,000.

DETROIT, MICH.—The Palace Model Laundry Co. is erecting a power plant on Pine Street.

DETROIT, MICH.—Sealed applications will be received at the U. S. Lake Survey Office, Old Custom House, Detroit, Mich., until Oct. 31, for permission to import into the United States from Canada electrical power generated from the waters of Niagara River. Further information upon application to Lt. Col. Mason M. Patrick.

FLINT, MICH.—The City Council has granted a franchise to the Independent Pwr. Co. for an electric railway from Flint to Fenton.

GRAND RAPIDS, MICH.—Preparations are being made by the Wyoming Park Improvement Association for the installation of an electric street-lighting system in Wyoming Park, a suburb of Grand Rapids, electricity to be furnished by the Grand Rapids-Muskegon Pwr. Co.

HOLLY, MICH.—Plans have been approved by the Michigan State Tel. Co. for improvements to the long-distance service between Grand Rapids and Holly, involving an expenditure of about $25,000.

KALAMAZOO, MICH.—The Michigan Tel. Co. is planning to make improvements and extensions to its local system, to cost about $15,000.

LANSING, MICH.—The Commonwealth Pwr. Co. is contemplating the construction of an electric railway between Lansing and Grand Rapids.

LINDEN, MICH.—The Independent Lt. & Pwr. Co. is contemplating the installation of an electric-light system here.

MANISTEE, MICH.—Estimates are being secured by the city of Manistee for the installation of a boulevard lighting system in the business district.

NEW BALTIMORE, MICH.—The Detroit United Ry. Co. is making extensive improvements to its plant here.

TECUMSEH. MICH.—Preparations are being made for the installation of an ornamental street-lighting system in the business district, for which $3,000 was raised among the merchants.

MOORHEAD, MINN.—The City Council has granted the Tri-State Teleg. & Tel. Co. permission to erect wires and cables along certain streets and alleys for exclusive long-distance telephone service.

ROCHESTER, MINN.—The Zumbro Pwr. Co. has submitted a proposition to the City Council offering to build a hydroelectric power plant on the Zumbro River at Zumbro Falls and to supply electricity to operate the municipal electric-light system at 2 cents per kw-hour for the first 1,000,000 kw and 1¾ cents for all above that amount; the company also offers to give the city $100,000 for the purchase of the water works if it accepts the contract. Should the offer be accepted the electric-light station, which is now in the heart of the city, would be moved to the site of the water-works plant, and the Zumbro company would furnish power to operate both systems.

BEVIER, MO.—At a special election held Oct. 8 the proposition to issue $11,000 in bonds to purchase the electric-light plant of the Bevier El. Lt. & Pwr. Co. was defeated.

KANSAS CITY, MO.—It is reported that plans are being considered by the Mayor to issue $2,000,000 in bonds for the purpose of erecting a distributing system to supply electricity for lamps and motors in this city. Energy for operating the system is to be purchased from the municipal electric-light plant in Kansas City, Kan.

NEVADA, MO.—Bonds to the amount of $40,000 have been voted to subscribe to the construction of the proposed electric railway from

Nevada to Lebanon, which is to be built by Thompson Brothers, of Kansas City, Mo.

ST. LOUIS, MO.—The Anheuser-Busch Brewing Association is planning to build a power house at 1017-1019 Pestalozzi Street, St. Louis, to cost about $28,000.

MISSOULA, MONT.—Sealed proposals will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until Nov. 18 for installing an electric passenger elevator in the United States post office, Missoula, in accordance with drawings and specifications, copies of which may be obtained at the above office or at the office of the superintendent, Missoula. Oscar Wenderoth is supervising architect.

RED LODGE, MONT.—The City Council has awarded the contract for installing a cluster street-lighting system in the business section to W. A. Talmadge, of Red Lodge, for $3,275. The contract calls for 32 standards carrying five lamps each.

BEATRICE, NEB.—The City Council is planning to install an ornamental street-lighting system. All wires will be placed underground in the business district.

HARVARD, NEB.—The Village Council has granted Elmer L. Jensen a 20-year franchise for the construction of an electric-light system here. It is proposed to equip the plant to supply a 24-hour service. The cost is estimated at about $7,000.

LINCOLN, NEB.—Sealed proposals will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until Nov. 29 for extension, remodeling, etc., including plumbing, gas piping, heating apparatus, electric conduits and wiring system, interior lighting fixtures and lifts of the United States post office and court house at Lincoln. Drawings and specifications may be obtained from the above office or from the custodian at Lincoln after Oct. 21. Oscar Wenderoth is supervising architect.

FALLON, NEV.—Plans are being considered for erecting a distributing system in Fallon to supply electricity for lamps and motors and also for street lighting. It is proposed to use arc lamps. Electricity will be secured from the government dam at Lahonton, a transmission line from the dam having already been erected.

BELLEVILLE, N. J.—The Council has instructed the lighting committee to enter into a contract with the Public Service El. Co. for the installation of arc lamps on Washington Avenue.

HARRISON, N. J.—The Council has granted the New York Tel. Co. permission to construct underground conduits on Harrison Avenue, First, Second, Third, Seventh and Washington Streets.

NEW BRUNSWICK, N. J.—The Board of Freeholders has awarded the contract for lighting the Albany Street bridge to the Public Service El. Co.

PHILLIPSBURG, N. J.—The special committee of the Phillipsburg Board of Trade in charge of preliminary plans for organizing a local electric light, heat and power company, has appointed a sub-committee to confer with Lehigh Coal & Navigation Co. in regard to entering into a contract with the latter to supply electricity to operate the proposed plant. T. F. McPherson is a member of the sub-committee.

CLAYTON, N. Y.—The Village Board has granted the Watertown Lt. & Pwr. Co. a perpetual franchise to supply electricity for lamps and motors here. J. B. Taylor is treasurer.

EAST SCHODACK, N. Y.—The Town Board has been authorized to negotiate with the Albany Southern R. R. Co. to install and maintain a street-lighting system here and to furnish electricity for commercial purposes.

HOOSICK FALLS, N. Y.—The Village Trustees have awarded the contract for street lighting to the Twin State Gas & El Co. for a period of five years. The present contract, which calls for 66 arc lamps and 46 incandescent lamps, will be changed to about 36 arc lamps, 91 tungsten lamps of 32 cp and 30 60-cp tungsten lamps.

MIDDLETOWN, N. Y.—Sealed proposals will be received by the State Hospital Commission, Capitol, Albany, N. Y., until Oct. 30, for power house, coal pocket and conduit, construction and plumbing work at the Middletown State Homeopathic Hospital, Middletown. Bids are to be received for each division of the work separately and no combination of bids will be received. Drawings and specifications may be consulted and blank forms of proposals obtained at the Middletown State Homeopathic Hospital, Middletown, and at the office of Herman W. Hoefer, Capitol, Albany. Plans and specifications may be obtained upon application to the state architect. T. H. McGarr is secretary of the state hospital commission.

ONTARIO, N. Y.—A petition has been filed with the town clerk asking for the establishment of an electric light district in the village of Ontario, extending from the eastern limits of the village to a point west of Ontario Center, the contract to be made with the Sodus Gas & El. Co. to furnish the service.

OSWEGO, N. Y.—Preparations are being made by the Retail Merchants' Association for the installation of an ornamental street-lighting system in the business district this fall.

RANDOLPH, N. Y.—The Randolph El. Lt. & Pwr. Co. is erecting a new power house. Two new 150-hp water-tube boilers have been installed and other improvements are under way. When improvements are completed a 24-hour service will be established and power lines extended to the mills and factories in the village.

ROCHESTER, N. Y.—The retail trade of the Chamber of Commerce has adopted a resolution recommending the chamber to use its influence with the City Council to secure the adoption of the magnetite arc lamps for Main Street.

ROME, N. Y.—The Rome & Oneida El. Ry. Co. has applied to the Public Service Commission for permission to build an electric railway from Rome to Westmoreland, Verona and Oneida, a distance of about 13 miles.

NEWBERN, N. C.—Bids will be received by the Board of Aldermen until Oct. 22 for rebuilding and remodeling of building for water and light plant. F. T. Patterson is city clerk.

RANDLEMAN, N. C.—The Randleman Pwr. Co. is reported to be in the market for a 100-kw direct-connected generating unit, 60 cycles, 2200 volts, three-phase; four valve or Corliss engine of about 100-hp, new or second hand.

REYNOLDS, N. D.—The proposition to issue $5,000 in bonds for the installation of a municipal electric-light plant will be submitted to the voters on Nov. 5.

WILLISTON, N. D.—The City Council has entered into a contract with the United States government for electricity generated at the irrigation plant. Under the terms of the contract the municipal plan will be held in readiness during the month of July in case the irrigation plant is taxed to its capacity. Electrically driven pumps, switchboards and other machinery will be installed at the power house.

CINCINNATI, OHIO.—The construction of a six-story power plant is contemplated by the Graydon estate. The proposed plant will be located at Sixth and North Streets and will cost about $75,000. Elzner & Anderson are architects.

CINCINNATI, OHIO.—Plans are being considered by the Lunkenheimer Co. for the construction of a new power plant in connection with its works at Main and Eighth Streets. Samuel Moyer is vice-president and general manager.

CLEVELAND, OHIO.—The Public Service Commission has granted the Arcade Service Co., of Cleveland, permission to purchase the power plant, distributing system, etc., located in the Cleveland Arcade and adjoining building, owned by the Cleveland Arcade Co.

COLUMBUS, OHIO.—Steps have been taken by the East Side Citizens' Association for extending the cluster-lamp street-lighting system on East Main Street, from Fifth Street to Kelton Avenue.

COLUMBUS, OHIO.—Proposals will be received by S. A. Kinnear, director of public service, until Oct. 23, for furnishing meters and transformers that will be required by the municipal electric-light plant until Jan. 1, 1913, in accordance with specifications on file in the office of the director of public service and the superintendent of the Department of Lighting, Dublin Avenue, from whom copies may be obtained.

DAYTON, OHIO.—The construction of an electric railway in East Highland, a suburb of Dayton, is under consideration. P. E. Sullivan and Joseph Green are interested.

KINGSVILLE, OHIO.—The Conneaut, Kingsville & Ashtabula Ry. Co. is planning to build an electric power plant to supply electricity for operating its proposed railway and for lamps and motors to residents along the line. The company is capitalized at $25,000. The incorporators are: William E. Hawley, Raymond C. Thompson, Julius F. Fox and Charles E. Hawkins.

MARIETTA, OHIO.—Plans are being considered for equipping the municipal electric-light plant to supply electricity for commercial purposes as well as street-lighting.

ROCKPORT, OHIO.—Sealed bids will be received by Fred Feuchter, clerk, until Oct. 28 for furnishing electricity for lighting the following thoroughfares: Lorain Street, from Highland Avenue to the westerly limits of the village; Berea Road, from Lorain Street to Brook Park Road; Riverside Avenue, from Lorain Street to the northerly limits village.

SPRINGFIELD, OHIO.—Plans are being considered for the installation of an ornamental street-lighting system in the business section of the city.

HINTON, OKLA.—The town of Hinton has engaged the Benham Engineering Co., American National Bank Bldg., Oklahoma City, Okla., to prepare plans and specifications for construction of an electric-light plant and water-works system and to act as consulting and supervising engineers for the town. An election will be called to vote on a $30,000 bond issue for same.

ASTORIA, ORE.—Surveys are being made by the United Railways Co. for a proposed extension of its railway from Banks through the Nehalem Valley to Astoria, a distance of about 55 miles.

BANKS, ORE.—Surveys are being made by the United Railway Co. for an extension of its railway from Banks to Astoria, Wash., passing through the Nehalem Valley.

CULVER, ORE.—The Cone El. Pwr. Co. is installing machinery at its power plant and expects to have its system ready for operation in about 60 days. The company will supply electricity to the Opal Springs water works and to the various flouring mills in the county.

GRANTS PASS., ORE.—The California-Oregon Lt. & Pwr. Co., of New Pine Creek, has entered into sufficient contracts with the residents of Fruitdale to insure the erection of a distributing line into that section. Many extensions will be made in that district.

LA PINE, ORE.—The Pringle Falls Pwr. & Wtr. Co., of Portland, has

entered into a contract with the La Pine Townsite Co., whereby the power company agrees to construct and maintain an electric railway into La Pine within three years. The company also agrees to erect and operate a transformer station here in connection with its power plant it proposes to install at Pringle Falls, 6 miles from La Pine, where from 10,000 hp to 12,000 hp will be developed.

MILTON, ORE.—Surveys are being made by L. E. Coyle, municipal engineer, and Geary Kimbrell, county engineer, for the purpose of securing an estimate of the cost of constructing a barrel flume to supply water to operate a light and water plant.

PORTLAND, ORE.—Arrangements are being made by the Northwestern El. Co. for the construction of a substation, to cost $300,000, and the erection of a large business building in Portland, involving a total expenditure of about $1,000,000. The company is also building a 20,000-hp hydroelectric plant on the White Salmon River.

EASTON, PA.—The committee appointed by the City Council to investigate the cost of installing an electric plant to supply electricity for commercial purposes has submitted its report. The cost of installing a 1000-kw plant, including power plant equipment, pole lines, meter installations, transformers and necessary conduits, is estimated at $250,000. A special election to vote on the proposition to issue bonds for the proposed plant is recommended by the committee.

EGYPT, PA.—The electric light company, recently organized, is preparing to install an electric distributing system to illuminate the town, which has been without electrical service since the American Cement Co. shut down its plants.

MEDIA, PA.—Preparations are being made by the Philadelphia & West Chester Trac. Co. for extending its railway to Media and Chester. H. S. Farquhar, of Upper Darby, is general manager.

PHILADELPHIA, PA.—Sealed proposals will be received at Depot of Supplies, U. S. Marine Corps, Quartermaster's Department, 1100 South Broad Street, Philadelphia, Pa., until Oct. 21, for furnishing 5000 lb. hard-drawn, triple-braided, weatherproof insulated copper wire No. 14, to be funished in coils, each coil to contain 130 lb. net weight. Lt. Col. Cyrus S. Radford is assistant quartermaster.

PINE GROVE, PA.—Arrangements are being made by the Pine Grove Lt., Ht. & Pwr. Co., which was recently granted a franchise here for the installation of an electric-light system. The company will soon apply to the State Department for a charter.

READING, PA.—The Metropolitan El. Co. is planning to build another substation. Walter J. Jones, 30 Church Street, New York, N. Y., is consulting engineer.

WILKES-BARRE, PA.—The Wilkes-Barre & Wyoming Valley Trac. Co. is contemplating double-tracking its railway from Vaugh's Corners to Harvey's Lake.

TIVERTON, R. I.—The Town Council has granted the Tiverton El. Lt. Co. permission to construct and operate an electric transmission line as proposed in its petition filed last July.

BARNWELL, S. C.—Bids will be received by the Commissioners of Public Works of Barnwell until Nov. 1 for furnishing all material and construction of electric-light plant and water-works system, plans and specifications for which may be seen at the office of the chairman at Barnwell, and at the office of Edward Hawes, Jr., engineer, Emaxcee Building, Greenville, S. C. Plans and specifications may be obtained from the chairman upon deposit of $10, which will be refunded on return of plans. J. M. Easterling is chairman.

ARTESIAN, S. D.—Bonds to the amount of $5,000 have been voted for the installation of an electric-light plant.

ADAMS, TENN.—Plans have been prepared by S. M. McMurray, of Nashville, Tenn., for construction of concrete dam and spillway for the Beech Valley Milling Co. An electric generating plant will be installed.

CHATTANOOGA, TENN.—Work has begun on the construction of the new electric railway to Chickamauga Park and Fort Oglethorpe by the Chattanooga Ry. & Lt. Co. The cost of the line is estimated at about $150,000. W. E. Boileau is general manager.

KNOXVILLE, TENN.—The Royal Marble Co. will soon purchase electrical equipment for a derrick of 60 tons lifting capacity, preferably of the self-contained type, the derrick having a 115-ft. mast and 100-ft. boom.

MEMPHIS, TENN.—The contract for electric wiring for the new Hotel Chisca to be erected in this city has been awarded to the Lytle El. Co. for $16,000.

BAY CITY, TEX.—The properties of the Bay City Ice & Lt. Co. have been purchased by Albert Emanuel Co., of Dayton, Ohio.

CLEBURNE, TEX.—Preparations are being made for the erection of a substation for the Texas Pwr. & Lt. Co. here. The station will be located on East Buffalo Creek at the terminal of Royal Street.

CLEBURNE, TEX.—Bids will be received by B. B. Barnes, county clerk, until Oct. 24 for wiring the new Johnson County court house. Lang & Witchell, Southwestern Life Bldg., Dallas, Tex., are architects.

PORT ARTHUR, TEX.—The Stone & Webster Management Association, Boston, Mass., has taken over the lighting system of the Port Arthur Wtr. Co. A 100-kw turbine is being installed at the power station and other improvements will follow. Arrangements have been made whereby the pumping station of the water-works system will be operated by electricity. The new company will be known as the Port Arthur Lt. & Pwr. Co. and will be capitalized at $600,000.

SAN BENITO, TEX.—Bonds to the amount of $10,000,000 have been authorized by the San Benito & Rio Grande Valley Ry. Co., the proceeds to be used to extend its railway system in the agriculture districts. The company already has 45 miles in operation and proposes to extend it to 250 miles. Interests connected with the Frisco railroad are said to be back of the project.

TEMPLE, TEX.—The Southern Trac. Co., which is building an interurban electric railway between Dallas and Waco, with a branch line to Corsicana, contemplates enlarging its plans with a view of making Temple the southern terminus of the main line, which will necessitate the construction of 33 miles additional.

TERRELL, TEX.—The East Texas Trac. Co., which was organized to build an interurban electric railway between Dallas and Terrell, is negotiating for the sale of its surveys and other holdings to the Stone & Webster Engineering Corpn., Boston, Mass. If the deal is consummated, work will soon begin on construction of the railway.

TEXARKANA, TEX.—The Southwestern Gas & El. Co. has taken over the local railway system and electric light and gas plants here. The company, which was incorporated in Wilmington, Del., has recently been granted a permit to do business in Texas.

WICHITA FALLS, TEX.—The proposition to issue $10,000 in bonds for the installation of additional street lamps will be submitted to the voters on Nov. 5. About 100 ornamental lamps will be placed in the business district.

OGDEN, UTAH.—Arrangements have been made whereby a new lighting system will be installed in the business district. The plans call for the installation of ornamental standards carrying arc lamps, 14 to each block, on Twenty-fifth Street, between Wall and Washington Avenues, and on Washington Avenue, between Twenty-second and Twety-sixth Streets. The Ogden Rapid Transit Co. is to furnish the standards and the Merchants' Lt. & Pwr. Co. will furnish current to maintain the lamps, the city to pay for same.

PROVO, UTAH.—Plans are being prepared by the Utah & Salt Lake El. Ry. Co. for the construction of an electric railway to connect Salt Lake City, Provo, Payson and Springville.

PROVO, UTAH.—The Telluride Pwr. Co., recently acquired by the Electric Bond & Share Co., of New York, is to take over the Knight Consol. Pwr. Co., of Provo, and the Davis & Beaver Canon Pwr. Co., of Utah. A new corporation with a capital stock of $20,000,000 and $10,000,000 in bonds will be organized. The company is planning to make extensive improvements and extensions, involving an expenditure of about $2,000,000. Negotiations are under way whereby the company will equip the Bingham and Garfield railroad for electrical operation and supply electricity to several large Utah mining properties.

SALT LAKE CITY, UTAH.—The Utah Lt. & Ry. Co. has awarded a contract for the construction of an electric railway to Black Hawk and Moreland to the Utah Constr. Co., of Ogden.

SALT LAKE CITY, UTAH.—Preliminary engineering work has been commenced by the Electric Bond & Share Co. on the Bear Lake hydroelectric project by which 80,000 kw will ultimately be generated and transmitted by electricity at from 100,000 volts to 150,000 volts to the Salt Lake City region. A steel tower line will be erected into Salt Lake City and substations will be built near Salt Lake City, Garfield and elsewhere. Many miles of 30,000-volt lines will also be erected. J. R. McClelland, chief engineer, is now in this district looking over the situation.

PITTSFORD, VT.—Arrangements are being made by the Rutland Ry., Lt. & Pwr. Co. to furnish electricity for lighting the town. It is proposed to extend the transmission line from the power house in Mendon.

LYNCHBURG, VA.—Contracts have been awarded by the Appalachian Pwr. Co., to Hancock & Sons, of Roanoke, aggregating $86,000, for work to be done at Saltville, Byllesby, Welch, Lick Branch and Bluefield.

NEWPORT NEWS, VA.—Plans have been completed for the installation of a new street-lighting system here. The plan provides for placing 48 luminous arc lamps on Washington Avenue and Jefferson Avenue, and replacing the old open arc lamps now in use with 250-watt Mazda lamps and erecting 50 100-watt lamps in the residential sections. The cost of the proposed system is estimated at $10,000. The street-lighting service is furnished by the Citizens' Ry., Lt. & Pwr. Co.

TAZEWELL, VA.—The Continental Devel. & Investment Co. is reported to have secured a franchise to build an electric railway on the public road between Tazewell and Graham. The Appalachian Pwr. Co., of Graham, is said to be interested in the project.

BREMERTON, WASH.—The city, it is reported, is contemplating the purchase of the plant of the Bremerton-Charleston Lt. & Fuel Co.

CONCRETE, WASH.—The Skagit River Tel. Co. is planning to extend its line from Rockport to Marblemount, Wash., a distance of 10 miles. William Jennings is president.

LATAH, WASH.—The city of Latah is planning to issue bonds to the amount of $11,000 for the installation of an electric-lighting system. A water-works system will be installed.

LEAVENWORTH, WASH.—The Washington Steel & Iron Co. is contemplating the construction of a large dam on the Wenatchee River and the installation of a hydroelectric power plant. E. H. Rothert is general manager.

NEPPEL, WASH.—The Grant Realty Co. is planning to extend its

telephone line to Ephrata to connect with the Pacific States Tel. Company's line there.

RIVERSIDE, WASH.—The Tunk Creek Tel. Co. is planning to erect a telephone line from Synarep to Anglin, Wash., a distance of 10 miles. J. H. Green is president.

SPOKANE, WASH.—The Washington Wtr. Pwr. Co. is erecting a high-tension transmission line from its distributing station at Wardner, Idaho, to Pine Creek, a distance of 2 miles, from which point branch lines will run to the Naob mine, 1 mile, and to the Surprise properties, 2 miles. The purpose of this line is to furnish electricity to the mining properties in this section.

TACOMA, WASH.—Application has been made to the City Council by P. H. Hebb, of Tacoma, for a 25-year franchise to supply electricity for lamps and motors here.

BURLINGTON, WIS.—Interests allied with the Milwaukee El. Lt. & Ry. Co., have purchased the capital stock of the Burlington Lt. & Pwr. Co., Burlington, for $100,000. The Milwaukee company will have no direct connection with the Burlington company other than the possible sale of electricity to operate the system.

SHAWANO, WIS.—The contract for furnishing and installing equipment for an electric light and power plant for the Shawano County Asylum, Shawano, has been awarded to the Central Construction Co., of Oshkosh, for $6,254.

SUPERIOR, WIS.—The City Council has granted the Superior Interurban Trac. Co. a 30-year franchise to construct and operate an electric railway in South Superior.

SUPERIOR, WIS.—The town of Superior has granted the Superior Steel Plant Trac. Co. a franchise for an electric railway from South Superior to the St. Louis River bridge.

WHITEWATER, WIS.—Preparations are being made for the installation of an ornamental street-lighting system here.

LANDER, WYO.—The Louis Lake Conservation Co. is contemplating the installation of a 30,000-hp hydroelectric power plant in connection with its irrigation project at Lander, plans and specifications for which are now being prepared. The office of the company is located at 612 New York Life Building, Kansas City, Mo. Prof. Schaad, of the Kansas State University, Lawrence, Kan., is consulting engineer.

OAK LAKE, MAN., CAN.—Plans are being prepared for the power plant for Leitch Brothers' Flour Mills, Ltd.

RAPID CITY, MAN., CAN.—A by-law authorizing the installation of an electric-light system here will soon be submitted to the ratepayers. J. R. Burland is Mayor.

WINNIPEG, MAN., CAN.—The City Council has decided to allow the Manitoba Government Telephone Commissioners permission to place an underground conduit on Salter Street for telephone wires.

WINNIPEG, MAN., CAN.—Plans are being considered by the municipal fire, water and light committee for enlarging the Point du Bois power plant. It is proposed to install two additional generating units, to cost about $250,000.

WINNIPEG, MAN., CAN.—The Light and Power Department will require transformers this fall as follows: One 9000-kw and three 3000-kw, three-phase, water-cooled transformers with necessary high-tension switch gear for the generating station, to cost about $100,000; two extra units, consisting of turbine and alternators, to cost about $150,000, will be required during 1913. J. G. Glassco, 54 King Street, is engineer.

ST. JOHN, N. B., CAN.—Plans are being prepared for extension of power plant and installation of new machinery to the Smythe Street power plant of the St. John Street Ry. Co., to cost about $50,000. H. M. Hopper is general manager.

AYR, ONT., CAN.—The ratepayers have voted in favor of the by-law providing for the purchase of the local electric-light plant.

HARRISTON, ONT., CAN.—The ratepayers have approved the by-law appropriating $11,000 for the installation of an electric-light plant.

OTTAWA, ONT., CAN.—The installation of 16 new arc lamps and 28 tungsten standards at once will be recommended by the Municipal Board of Control.

STRATFORD, ONT., CAN.—Sir William Mackenzie has decided to build a street railway in Stratford and has instructed Secretary Moore and Engineer Rothery to proceed at once with preliminary work. The company has applied for a 25-year franchise, which will be submitted to the ratepayers.

TORONTO, ONT., CAN.—It is proposed to supply the greater part of York Township with hydroelectric power if 200 or 300 signed contracts can be secured. The cost of the installation is estimated at about $40,000. Work has already been started in the eastern part of the township near Todmorden. Pole lines will be erected on all streets south of Eglinton Avenue.

WALKERVILLE, ONT., CAN.—The City Council has decided to double the number of electric street lamps now in use.

WINDSOR, ONT., CAN.—Plans are being considered by the lighting commission for installation of new equipment for the municipal electric-light plant, to cost about $20,000. It is proposed to install two new generating units, consisting of generators and engines. If plans are approved by the City Council, a by-law authorizing the expenditure will be submitted to the ratepayers at the next municipal election.

New Industrial Companies

J. J. AGUTTER & COMPANY, of Seattle, Wash., has been incorporated by John J. Agutter and P. E. Ridings. The company is capitalized at $10,000 and proposes to do a general electrical business.

THE BINFORD ELECTRIC COMPANY, of Richmond, Va., has been incorporated with a capital stock of $50,000 to conduct an electrical jobbing business. The officers are: Branch Johnson, president; C. H. Reiley, vice-president, and Hammond Johnson, secretary and treasurer.

THE CHARLOTTE STORAGE BATTERY & MANUFACTURING COMPANY, of Charlotte, N. C., has been incorporated with a capital stock of $100,000 by Jesse W. Garrett, Mrs. B. Garrett and Clyde A. Duckworth.

THE C. O. BARTLETT & SNOW COMPANY OF CANADA, LTD., of Montreal, Que., Can., has been granted a Dominion charter to deal in, manufacture and install elevating and conveying machinery, power transmission machinery engines, boilers, hoisting machinery, garbage reduction machinery, paint machinery, grain and cereal machinery and to do general engineering, manufacturing and construction work. The head office of the company will be located at 232 St. Catherine Street, Montreal.

THE ELECTRIC TIME & MANUFACTURING COMPANY, of Lafayette, Ind., has been incorporated with a capital stock of $10,000 for the purpose of manufacturing an improved electric clock and time-keeping device invented by Thomas R. Moore, an instructor of Purdue University. The directors are: Albert E. Bradbury, Charles R. Moore and Horace W. Astire.

New Incorporations

SHREVEPORT, LA.—The Texas-Louisiana Trac. Co. has been organized with a capital stock of $1,000,000 for the purpose of building an electric railway between Longview, Tex., and Shreveport, La., via Marshall and Jefferson, Tex. The proposed railway will be 65 miles long. The officers are: J. K. Blevins, president; T. C. Morgan, vice-president; W. K. Ackman, secretary, and J. S. Hurst, treasurer.

RISING SUN, MD.—The Rising Sun El. Lt. & Wtr. Co. has filed articles of incorporation with a capital stock of $45,000 to build and operate an electric-light plant to furnish water in Rising Sun. The directors are: Calvin R. Green, John W. Whittock and Lincoln Harm.

NEW YORK, N. Y.—The Municipal Utilities Corpn. of New York City has filed articles of incorporation under the laws of the State of Delaware for the purpose of constructing, operating public works, plants, railways, and to do a general utilities and public service corporation business. The capital stock is placed at $25,000,000. Elmer E. Holmes and J. M. Sullivan are among the incorporators.

MANCHESTER, TENN.—The Stone Fort Pwr. Co. has been organized by W. G. Cummings, H. T. Brown, Mrs. F. H. Wooten and John Chumbley. The company has leased sites at Big Falls and Little Falls, a short distance from Manchester, where hydroelectric power plants are being constructed. The Little Falls power plant will be completed in about three months.

Trade Publications

RESISTANCE UNITS.—Bulletin No. 4973 of the General Electric Company illustrates and describes its resistance units for various motor-starting and speed-controlling rheostats.

LIGHTING SPECIALTIES.—Catalog B-20 of the Benjamin Electric Manufacturing Company, 120 South Sangamon Street, Chicago, which is just off the press, is a well-printed, nicely arranged, eighty-page illustrated publication. It gives information with respect to the essential devices listed in previous catalogs and bulletins and includes, as well, illustrated descriptive matter on new articles manufactured by the Benjamin company. Chief among the latter may be mentioned single-unit ceiling fixtures, street car fixtures, porcelain-lined twin sockets, lever and pull angle sockets and ceiling and pendent lock guards. In connection with the lighting system developed by this company there is manufactured a unique line of industrial devices, many of which are described in this new catalog. A divisional index, an alphabetical index, and a key to catalog numbers for all letters make reference to any particular device especially easy.

Business Notes

THE GOULDS MANUFACTURING COMPANY.—Mr. C. H. Warfield has resigned his position as secretary and treasurer of the Goulds Manufacturing Company, Seneca Falls, N. Y. Mr. B. R. Wells has been appointed treasurer and Mr. H. S. Fredenburgh secretary, to succeed Mr. Warfield.

MESSRS. WALKER & KEPLER, electrical contractors, Philadelphia, have been appointed agents for the Columbia Incandescent Lamp Works of the General Electric Company for Philadelphia and surrounding territory.

MR. FRANK KOESTER has removed his office from 115 Broadway to the Hudson Terminal Building, 50 Church Street, New York, for the practice of consulting engineering in steam and hydroelectric power-plant work, electric transmission and traction.

GENERAL VEHICLE COMPANY.—President P. D. Wagoner has announced the following appointments to the staff of the General Vehicle Company: Mr. C. W. Squires, Jr., assistant to the president, is made sales manager; Mr. Irwin W. Howell is made assistant to the president; Mr. G. W. Wesley, vice-president, vice Mr. R. McA. Lloyd, resigned; Mr. J. R. C. Armstrong, engineer of the electric division; Mr. H. G. McComb, engineer of the gasoline division; Mr. L. E. Lentz, superintendent of the electrical division; Mr. A. P. Bourquardez, district manager of New York sales office. Mr. C. V. Riede, of the general sales office, has been transferred to the St. Louis office, and Mr. George D. Smith to Cincinnati.

BROWN, WILLIAMS, BELL, HANSON & BOETTCHER will hereafter continue the practice of patent and trade-mark law formerly carried on by the firm of Brown & Williams. The members of the recently enlarged partnership include Charles A. Brown and Lynn A. Williams, of the original firm, and Albert C. Bell, Harvey L. Hanson and Arthur H. Boettcher, the new partners, who for several years have been actively associated with Brown & Williams. Mr. Bell is a graduate of Cornell University and was for several years in charge of the patent department of the Stromberg-Carlson Telephone Manufacturing Company. Mr. Hanson has had a varied experience in the general practice of law and many years' association with Mr. Brown in patent and trade-mark matters. Mr. Boettcher, who received his training in the engineering department of the University of Wisconsin, has made a specialty of patent and trade-mark law. The offices of the new company will be at 1550 Monadnock Block, Chicago, Ill.

Weekly Record of Electrical Patents

UNITED STATES PATENTS ISSUED OCT. 8, 1912.

[Prepared by Robert Starr Allyn, 16 Exchange Place, New York.]

1,040,257. INTERLOCKING TUBULAR CONSTRUCTION; F. Barr, New York, N. Y. App. filed Feb. 9, 1912. For socket-shell joint, etc.

1,040,292. ELECTRIC CONTROLLER; A. C. Eastwood, Cleveland, Ohio. App. filed Sept. 24, 1910. Series of individually operated switches in sequence.

1,040,309. SWITCHING DEVICE; D. D. Gordon, Chicago, Ill. App. filed June 20, 1911. Push-button switch with ball contact.

1,040,315. GRAPHITE BRUSH; W. H. Hardman, Schenectady, N. Y. App. filed May 31, 1912. Contains about 2 per cent. of carborundum.

1,040,331. DETACHABLY MOUNTING A FUSE FORMED WITH TERMINALS OR CONTACTS OF KNIFE-BLADE TYPE; B. D. Horton, Detroit, Mich. App. filed June 25, 1912. Adjustable clip.

1,040,333. FILAMENT SUPPORT; J. W. Howell, Newark, N. J. App. filed April 6, 1910. Knife-edge welded joint.

1,040,359. ELECTRIC CONTROLLER; J. A. Latimer, Youngstown, Ohio. App. filed March 2, 1911. For regulating furnaces, valves, switches and measuring devices.

1,040,366. LAMP-LOCKING DEVICE; J. C. Manley, J. Thulin and P. J. Smith, Chicago, Ill. App. filed Dec. 14, 1911. Key lock for lamp bulb.

1,040,367. LAMP-LOCKING DEVICE; J. C. Manley, J. Thulin and P. J. Smith, Chicago, Ill. App. filed Dec. 14, 1911. Key lock indents the socket shell.

1,040,370. WASHING MACHINE; P. McDorman, Dayton, Ohio. App. filed July 24, 1912. Electrolytic tank with revolvable clothes receptacle.

1,040,378. ELECTRIC SIGALING SYSTEM; W. L. Miller, Madison, Wis. App. filed June 16, 1911. For machine-tool control.

1,040,379. PROCESS OF TREATING NITRIC ACID BY ELECTROLYSIS; M. Moest and R. Müller von Berneck, Höchst-on-the-Main, Germany. App. filed July 26, 1911. Nitric acid electrolyte and carbon cathode.

1,040,381. PANELBOARD CONSTRUCTION; E. S. Morrell, Philadelphia, Pa. App. filed Jan. 16, 1912. Separable switch-units.

1,040,389. ELECTRIC SIGNALING DEVICE; R. C. Nevin, Berkeley, Cal. App. filed Dec. 29, 1910. For desk telephones.

1,040,418. METHOD OF JOINING METALS. A. F. Reitzel, Lynn, Mass. App. filed Oct. 2, 1906. Electric welding for sheet metal.

1,040,428. DEVICE FOR AIDING THE HEARING; E. W. Schneider, New York, N. Y. App. filed May 18, 1908. Socket battery connection.

1,040,429. DEVICE FOR AIDING THE HEARING; E. W. Schneider, New York, N. Y. App. filed Feb. 11, 1910. Cover lock.

1,040,440. BREAKER FOR ELECTRIC CIRCUITS; F. L. Sessions, Columbus, Ohio. App. filed Oct. 29, 1903. Magnetic blow-outs.

1,040,455. ELECTRIC-SWITCH CONTACT; L. Tatum, Milwaukee, Wis. App. filed Aug. 27, 1907. Rough faces for oil-immersed type.

1,040,475. ELECTRIC-LIGHT DISPLAY SYSTEM; H. E. Way, Easton, Pa. App. filed April 29, 1911. The design displayed in the lamps is also displayed in the switches.

1,040,496. SYSTEM OF ELECTRICAL DISTRIBUTION; W. L. Bliss, New York, N. Y. App. filed Aug. 4, 1904. Storage-battery generator train lighting.

1,040,526. COIN COLLECTOR; A. F. Dixon, New York, N. Y. App. filed Jan. 7, 1909. For telephone pay stations.

1,040,541. COUPLING FOR NON-CLOSABLE CIRCUIT-BREAKERS; K. Höhn, Schaffhausen, Switzerland. App. filed Jan. 24, 1911. Automatic releasing device.

1,040,546. ELEVATOR CONTROL; J. D. Ihlder, New York, N. Y. App. filed Oct. 31, 1908. Push-button control.

1,040,586. AUTOMATIC ELECTRIC SPEED REGULATOR; M. D. Selden and R. L. Graves, Memphis, Tenn. App. filed Feb. 28, 1911. Glow-lamp speed indicator with audible signal.

1,040,595. ELECTRICALLY HEATED UTENSIL; A. A. Warner, New Britain, Conn. App. filed Feb. 1, 1912. Locking the heating unit.

1,040,620. INSULATOR CLAMP; W. G. Clark, New York, N. Y. App. filed Nov. 21, 1911. For holding street arc lamp cables, etc.

1,040,629. TELEPHONE SYSTEM; E. R. Corwin, Chicago, Ill. App. filed Feb. 3, 1908. Automatic ringing and supervisory signals.

1,040,630. TELEPHONE SYSTEM; E. R. Corwin, Chicago, Ill. App. filed Feb. 20, 1908. Controlling the line and supervisory signals and the operators' circuit.

1,040,631. BUSY TEST FOR TELEPHONE SYSTEMS; E. R. Corwin, Chicago, Ill. App. filed Feb. 20, 1908. Automatic control for multiple system.

1,040,632. TELEPHONE SYSTEM; E. R. Corwin, Chicago, Ill. App. filed Aug. 7, 1908. Party-line signal.

1,040,633. TELEPHONE SYSTEM; E. R. Corwin, Chicago, Ill. App. filed Jan. 18, 1909. Multiple jack switch exchange.

1,040,634. TELEPHONE-EXCHANGE SYSTEM; E. R. Corwin, Chicago, Ill. App. filed March 17, 1909. Trunk-line equipment for substation work.

1,040,635. TELEPHONY; C. A. Bals, Chicago, Ill. App. filed May 22, 1911. Switch mechanism for automatic selector.

1,040,636. TELEPHONY; C. A. Bals, Chicago, Ill. App. filed May 22, 1911. Party-line system.

1,040,637. TELEPHONE TRANSMITTER; R. Royal, Chicago, Ill. App. filed Aug. 11, 1911. Granular carbon type.

1,040,680. TROLLEY WHEEL; H. Holland, Cleveland, Ohio. App. filed Nov. 20, 1911. Spring-pressed contact rings.

1,040,704. AUTOMATIC ELECTRIC REGULATOR; H. Leitner, Mabury, Woking, England. App. filed Feb. 26, 1910. Lamp regulation for train lighting, etc.

1,040,705. INTERLOCKING MECHANISM; H. E. Leppert, New Britain, Conn. App. filed March 14, 1911. Multiple plunger switch.

1,040,715. CENTERING DEVICE; H. Mann, Brooklyn, N. Y. App. filed Dec. 3, 1909. Sensitive electrical device for machine tools.

1,040,760. ELECTRIC CHAIN-WELDING MACHINE; A. F. Rietzel and G. E. Barstow, Lynn, Mass. App. filed May 11, 1907. Automatic device with re-heater (191 claims).

1,040,762. PROTECTIVE COVERING FOR ATTACHMENT PLUGS; M. R. Rodrigues, New York, N. Y. App. filed Dec. 7, 1911. The plug and cap are inclosed in a single shell.

1,040,771. REAR INDICATOR FOR VEHICLES; W. H. Sammons, Philadelphia, Pa. App. filed June 3, 1910. To indicate contemplated turning.

1,040,789. TROLLEY; H. Shaffert, East Pittsburgh, Pa. App. filed July 15, 1912. Harp with guards to prevent jumping.

1,040,796. TELEPHONE-RECEIVER HOLDER; S. C. Sladden, New York, N. Y. App. filed May 16, 1912. For holding a receiver in position at the ear.

1,040,800. SAFETY ATTACHMENT FOR BOILERS; W. P. Smith, Locust Grove, Va. App. filed July 15, 1911. Signaling float.

1,040,818. ELECTRIC FURNACE; O. Vogel, Wilmersdorf, Germany. App. filed Feb. 11, 1910. For melting quartz and glass.

1,040,830. SECTIONAL ELECTRODE; A. M. Williamson, Niagara Falls, N. Y. App. filed March 4, 1912. Stronger graphite joint.

1,040,863. OVERLOAD CONTROL FOR METAL ROLLS; G. H. Blaxter, Beaver, Pa. App. filed Jan. 22, 1912. For motor-driven reducing rolls.

1,040,883. CIRCUIT-CLOSER; C. A. Castle, Oldham, S. D. App. filed Dec. 19, 1911. For telegraph lines.

1,040,904. TROLLEY GUARD; S. C. Distefano, Baltimore, Md. App. filed Feb. 8, 1912. Spring-pressed pivoted guard arms.

1,040,923. ELECTROPLATING APPLIANCE; J. A. Fraser, Benton Harbor, Mich. App. filed April 26, 1912. Spring jaws for supporting the work.

1,040,927. ELECTRIC SAFETY DEVICE FOR THE FLOWING OUT OF EXCESS VOLTAGE; G. Giles, Fribourg, Switzerland. App. filed Aug. 12, 1908. Resonance phenomena of low-frequency cable network.

1,040,937. COMBINATION GAS BURNER AND ELECTRIC GAS IGNITER; H. D. Grinnell, Pittsfield, Mass. App. filed June 6, 1912. For automobile acetylene lights, etc.

1,040,940. ART OF RAILWAY SIGNALING; W. Grunow, Jr., Waterbury, Conn. App. filed May 10, 1911. Automatic block system.

1,040,941. CIRCUIT-CLOSING DEVICE OR SWITCH FOR USE IN CONNECTION WITH ELECTRIC OR OTHER RAILWAYS; W. Grunow, Jr., Waterbury, Conn. App. filed May 10, 1911. Frictionally retarded inertia device.

1,040,971. INSULATING JOINT; C. Wirt, Philadelphia, Pa. App. filed April 24, 1907. Gas and electric fixture.

1,040,974. ALARM BELL; H. P. Christianson, Oakland, Cal. App. filed Dec. 27, 1911. Portable device.

13,475 (reissue). FITTING FOR ELECTRIC CONDUITS; W. C. Robinson, Pittsburgh, Pa. App. filed March 30, 1911. Lamp socket and coupling. (Original Patent 971,216, dated Sept. 27, 1910.)